The Chemical Age

VOL LXI 17 DECEMBER 1949 No 1588

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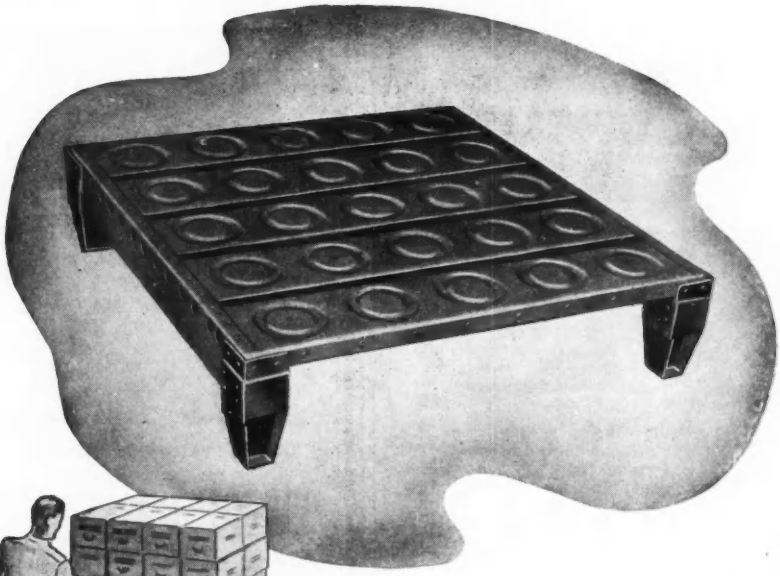

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The Chemical Age

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Atomic Energy Prospects

SPECULATIONS by the few who are competent to offer realistic views on the subject of atomic energy are with few exceptions surprisingly in agreement on one point. In no country will the vast gift of abundant energy which atomic piles could yield to industry and human amenity in general come within reach in the near future. Time estimates vary, but not the intention, which sensibly aims to discourage premature planning based on an uncertain quantity. Yet, so profound—and fascinating—are the prospects, it would be less than human deliberately to exclude a tentative estimate of what may be the effects in industry, and especially in chemical industry, when nuclear physicists, chemists and chemical engineers finally overcome the formidable difficulties of canalising the greatest flow of artificial heat to be generated. It is hoped that a useful light will be cast on these possibilities at the fourth World Power Conference in London next July.

An interesting introduction has meanwhile been offered by Professor Robert S. Aries (Brooklyn Polytechnic, New York) in a review for French chemists* of what may be the results in some of their own industries. Professor Aries does not fully support the remote view; he thinks the practical uses on a large scale of the atomic source of power may be much nearer than is generally anticipated.

It is generally agreed that atomic energy will be commercialised in the first place in the form of electric power; and it would thus interest primarily those electro-chemical branches of industry already mainly dependent on electric power. They would need to make no radical change in plant and equipment. In other branches of chemical industry using other sources of power careful study would have to be given to the changes in plant organisation and cost.

The use of the new source of energy would undoubtedly be regulated largely by the factors of cost, its special properties and adaptability. Little precise information is available regarding two of these, but Professor Aries believes that the unit cost would be approximately the equivalent of 1 cent per kWh. That is about the same as the present power cost in some electrochemical industries. But, says Professor Aries, happily only the initial installations would need that tariff level: later ones could in all probability reduce power charges to 0.4 or

* Chim et Ind. 1949, Nov., 62, 497-502.

On Other Pages

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0.5 cent. It has to be remembered that the cost of coal and oil is likely to rise continually and resources are not getting larger. The great cost factor in atomic power is the fixed or capital costs; running costs or consumption of material—uranium or thorium—are negligible. In that, an atomic energy plant resembles a hydro-electric, rather than a thermal, power station.

Much of the power used in chemical industry is concentrated in the electrochemical and electro-metallurgical branches; power costs in the heavy chemicals branch, excepting caustic soda and chlorine, are relatively low. The manufacture of sulphuric or hydrochloric acid, for example, requires no more than 35-36 kWh per ton produced. For ammonia synthesis, on the other hand, coal costs may represent at least half the cost price.

The installation costs of a hydro-electric plant may reach colossal figures, and require 50 years to pay off capital charges. Few private concerns can indulge in such long-term budgeting. In France, as elsewhere, it is an obvious condition that atomic power plants should be installed in large manufacturing centres, present or potential. If power were available, such centres could be created jointly with the appropriate generating station. The use of large blocks of power, directly rather than indirectly, should be the objective. In the manufacture of fertilisers such as superphosphates, the present wet method with sulphuric acid could be immediately replaced by an electric furnace process with large power expenditure per ton, in the neighbourhood of 13,000 kWh. There is little doubt that chemical enginers will find many other similar examples. While hydro-electric power stations are very limited as to site and proximity to consumers and coal costs increase rapidly with transport and other charges, atomic power is subject to none of these limitations.

Professor Aries finally exhibits a prospect which will apply equally to any country which develops the atomic source of energy. French chemical industry would doubtless undergo radical changes in distribution and organisation. The steel works of Alsace and Lorraine would be able to treat ore locally available with atomic energy supplied on the spot. This could also replace coke required in blast furnaces or supply electric power for smelting and rolling. The possibilities in many directions are obviously vast and revolutionary, reaching out beyond the confines, extensive as these are, of chemical industry alone.

Notes and Comments

Chemists Needed

IF demand for their services can be taken as a reliable criterion, prospects for most chemistry graduates are excellent, and are likely to remain so for some years to come. The authority for that view, which in general underlines the evidence which has come from many other directions since the war, is one of the Ministry of Labour surveys issued last week, giving for the first time, a factual account of the relationship between national needs of technicians and scientists and the number and quality of those coming from the enlarged educational centres. While the Ministry's tentative approach to the possible future numbering and allocation to industries of scientists of various sorts has roused little enthusiasm among those most intimately concerned, judging by the common attitude towards the Technical and Scientific Register, the five reports now rendered, including those on Chemistry and Physics, are in a different category. They present the views of practical and expert people including leading practitioners of the professions concerned, and representatives of the universities and profesional institutions, as well as of the Government departments—and, it is assured, they have had an entirely free hand in collecting and interpreting the evidence of what industry and the research departments must have in the next five to ten years.

Numbers Doubled

THE vitality of present-day chemistry gains a further testimony in the report of the specialist subcommittee, recording that, although chemistry has succeeded in doing what the Barlow Committee urgently recommended in 1946 for all the sciences, in doubling its number of qualified people, " saturation point " is very far from being reached. The demand at the present high level is likely to continue for many years, this committee forecasts. The report does more than record the facts. It is eminently constructive and is not limited by whatever has been considered acceptably orthodox in the past. That is evidenced by the committee's observations on the new intake, and on other things. Of tomorrow's chemists it asserts: " Too many young men undertaking postgraduate training are encouraged to regard research in pure science as the only worth-while carer for a chemist. In consequence, such men enter industry with a wrong attitude of mind and as a result have little interest or enthusiasm for the practical application of science. Industry's requirements on the production side will never be wholly and satisfactorily filled with the chemist of second rate ability. We suggest that the university departments of chemistry should endeavour to assess individual capabilities and personalities to ensure that both research and process needs are met adequately and appropriately."

Neglected Thermodynamics

THE decision of the Council of the Senate of Cambridge University to create, next October, a professorship of applied thermodynamics affords encouraging evidence of the growing readiness of the universities to recognise the urgency of some current needs of the moment to which little or no attention has been paid in the past. The comparatively recent admission of chemical engineering as a sufficiently well defined science to merit a university chair seems to have indicated a profound change of outlook, of which the decision to teach thermodynamics at Cambridge is the most convincing example. The mathematical treatment of the relation of heat to mechanical and other forms of energy has understandably held the rôle of Cinderella among the sciences, perhaps because it requires of its practitioners a mathematical attainment on a par with the physicist's and offers even tardier satisfactions to those looking for practical applications of theory. Yet, an enterprising employment of thermo-

dynamics is most evidently fundamental to continuous increase in efficiency of a host of industries, while atomic power projects will probably render this branch of science even more indispensable. All the newer forms of propulsion are more or less closely dependent upon the relationship between heat and energy. Cambridge University authorities will be congratulated in this connection for having had an ear to the ground (and an observant eye on the future), and as the recipients of the Imperial Chemical Industries' offer of £50,000 during the next seven years to support the new Hopkinson and Imperial Chemical Industries Professorship of Applied Thermodynamics. The two gifts supporting this research and teaching undertaking commemorate Bertram Hopkinson, engineering professor at King's College, London, who was killed in the 1914-18 war, and also I.C.I's expert estimation of the route by which some of the next industrial advances should come.

Tackling Water Pollution

THE possibility that there would be substantial changes in the legislation intended to keep within bounds the pollution of inland waterways and perhaps some tidal waters is not a new one. Chemical industries, which in most instances have willingly undertaken the expensive task of rendering their trade effluents harmless, are unlikely to take alarm at the proposals of the expert sub-committee, issued this week (page 835, this issue) of which the passing of a new Act of Parliament to replace the increasingly ineffectual Rivers Pollution Prevention Act of 1876 is the keynote. It is reassuring to know that, in its plans to empower the future River Boards to procure some degree of uniformity in deciding what is a reasonable tolerance, the investigating committee has had a keen appreciation of what is practicable and what constitute the worst sources of river pollution. Regardless of stories of streams having been converted into "chemical drains," the latest recommendations do not disguise the identity of the principal culprits, the sewage disposal plants, whose capacity has now to be very greatly increased and whose efficiency, impaired by lack of men and materials during the war, is not adequate even for present requirements. The aims are now to make the sewage disposal departments accept a greater responsibility for the disposal of trade wastes, which in many cases will call for drastic enlargement of existing capacity, and to limit the privilege of some private firms of discharging any amount of effluents, treated by "the best practicable means reasonably available" through any outfall which was in use when the 1875 Act was framed. "Reasonably available" is the qualification which, it is safe to predict, will determine all future work towards securing even a moderate improvement in the state of water courses in the industrial regions.

The 1950 Year Book

THE CHEMICAL AGE YEAR BOOK for 1950, which "C.A." subscribers have received this week, is one of the small class of technical literature which does not add to the embarrassment felt by those who are called upon to digest a spate of specialised publications in their leisure moments. The 1950 Year Book brings together the type of classified information—about sources of plant, materials and services, technical, legal and commercial affairs, organisations, officials and current literature for chemists—which has not all to be absorbed at short notice and the need for which continues throughout the year. Among new features, the review of recent literature concerned principally with the analysis of inorganic substances has a value which will ensure its preservation long after the information afforded by some other sections has been superseded by the 1951 Year Book. It is, of course, not the only contribution whose usefulness will not end when the year has run its course. The considerably enlarged Buyers' Guide remains one of the most informative directories available to those needing to find quickly the principal sources of plant, instruments and chemicals.

NEW CHEMICAL CENTRE

A Lead by Durham University

THE new chemistry department at King's College (Durham University), Newcastle-upon-Tyne, was officially opened on December 10 by Sir Robert Robinson, president of the Royal Society. The five-storey building, which houses the new department, is already in use. There are three lecture theatres, the largest of which seats 300, five teaching laboratories and a number of research sections.

Only the Prelude

Sir Robert Robinson observed that chemistry occupied a central position between the sciences and had relations through physics with mathematics and through bio-chemistry with the fundamental biological sciences and medicine. It was accordingly of great importance that one of the first buildings to be erected under the King's College extension scheme should be a chemical block.

It was a mistake, said Sir Robert, to regard chemistry as a highly developed science. No part of chemistry had yet been completely worked out. "In fact, I doubt if we know much about the subject at all," he added. A great deal more research work was needed.

Until recently nobody had suspected that two common substances, such as methyl alcohol and urea, could be transformed into a solid. Sir Robert carried out an experiment to prove that it could. "Do you know," he said, "there is a great deal of money in this sort of thing."

Lord Ridley presided at the ceremony which was attended by distinguished chemists from other institutions.

November's Steel Record

PRODUCTION of steel ingots and castings in November was at an annual rate of 16.358 million tons, compared with 15.959 million tons the previous month, and 15.76 million tons in November 1948.

This was only slightly lower than the peak figure established in May, when the annual rate was 16.409 million tons.

The target set for the industry for the year in the Economic Survey was 15.25 to 15.5 million tons, and during the first three-quarters of the year an annual rate was achieved of 15.449 million tons.

Output of pig iron also showed an increase, to an annual rate of 9.745 million tons a year ago, and 9.565 million tons in October this year.

PETROLEUM & TIN IMPORTS

Chancellor on Balance of Trade

THE new chemistry department at may, before long, need to restrict dollar imports further was called to mind by some observations by the Chancellor of the Exchequer (Sir Stafford Cripps) at a Press conference in London last week.

Petroleum and tin were singled out as large contributors to the unbalance between United Kingdom and overseas trading accounts. Even "sterling oil," the Chancellor said, had in it a considerable element of dollar cost, and economies throughout the sterling area were therefore essential unless we were to go without more essential foodstuffs or raw materials.

£50 Million a Year

Tin from Bolivia was one of the major items, accounting for an expenditure during the past 12 months of about £50 million on imports from the American account countries. British oil companies incurred very heavy operating expenses in dollars in Venezuela, and to a lesser extent in Colombia, whereas, as markets for our exports, most of these countries were comparatively small and difficult.

American account countries (largely South American) were, however, together an important source of U.K. dollar earnings; during the past year exports to them had totalled £25-£30 million, to which chemicals had contributed £1 million.

In Venezuela the most important possibilities existed for increasing U.K. exports. An unrestricted, expanding and relatively accessible market, it was virtually untapped so far by U.K. exporters, said the Chancellor. Yet, of current U.K. exports to Venezuela over half the total was made up of equipment for British oil companies for which there was no direct dollar return.

Of other countries to which we paid gold or dollars, Persia was by far the most important. Owing to our great interest in Persian oil we had to pay out dollars to cover that country's essential purposes in the dollar area. Tyres and tubes, rayon, pharmaceuticals and electrical goods were among Persia's more important imports from the dollar area, but she would be willing to purchase such goods from sterling countries, provided they were competitive in price and time of delivery.

CEYLON'S COCONUT OIL

New U.K. Contract Talks Fail

THE talks between the U.K. and Ceylon (THE CHEMICAL AGE, *61*, 781) regarding a contract for copra and coconut oil for 1950 are reported to have failed, no agreement having been reached either with regard to a long-term contract or the price for 1950. The export control of coconut products is thus likely to continue —writes our Colombo correspondent.

The hitch arose over the price of Rs.250 for a candy of copra, which Ceylon is said to have demanded. The British delegation was prepared to offer £5 less than the present contract price of £55 per ton for only one year; the Ceylon officials wanted a three-year contract. This brought the discussion to an abrupt end. The British delegation cabled home for instructions on this point, but apparently H.M. Government was not prepared to concede Ceylon's demands.

Ceylon has already fulfilled her contract with the United Kingdom for this year by shipping 40,000 tons in terms of coconut oil. Pakistan has also received almost the entire quantity of 8000 tons in terms of coconut oil, which the 1949 U.K. contract provided for.

The British delegates to the talks, Mr. L. G. Fisher and Mr. G. Wigglesworth, of the Oils and Fats Division of the Ministry of Food, left for London by air at the conclusion of the talks.

Prices Rise in Canada

SEVERAL drastic price increases have lately taken effect in the chemical fields in Canada, reports the Toronto Purchasing Agents' Association. Caustic soda and chlorine were advanced $5 per ton in carload quantities in order to meet increased cost of equipment, maintenance and freight charges. Trichlorethylene advanced $1 per cwt.; perchlorethylene advanced 75 cents per cwt. and 66 per cent ammonia advanced $1 per cwt. There was no increase in the price of anhydrous ammonia in tank cars. The price of some industrial alcohol was decreased 5 cents per gal.

These advances contributed to the 3 per cent increase in the price of glass announced on October 28, due partially to chemical advances in conjunction with rising costs of freight, maintenance, etc. There have been no changes yet in such items as soda ash and coal chemicals.

Further increases in the chemical field are expected in the coming months.

INDIAN SHELLAC REVIVAL?

Hope of More Competitive Prices

AN expected bumper crop of shellac, and the devaluation of Indian currency are factors which are expected to help substantially to re-establish Indian shellac in hard currency areas where, in recent years, demand has been reduced by competition of the synthetic resins.

The Government of India has requested the Bengal Government to ban forward trading in shellac, which is expected to end speculation and to steady prices.

The synthetic product is dearer than genuine shellac, and according to current crop estimates, a decline in the price of the natural product is indicated.

Annual exports of shellac from India total about 27,000 tons, their value being Rs.9 crores. In 1948 shellac accounted for 2.3 per cent of India's total exports, as against 0.7 per cent in 1938. More than half the exports in 1948 went to hard currency areas. At present about 94 per cent of India's production is exported.

Prices during the past few months have ranged between Rs.140 and Rs.160 per maund. A report issued by Dr. P. K. Bose, Director of the Research Institute at Ranchi, after his recent tour abroad, states that if India wants to capture the world market the price of shellac should be established at about Rs.100 per maund.

Important Vitamin Synthesis

A CONCENTRATE of vitamin B_{12} obtained from deep-fermentation of the mould streptomyces, has been marketed by Glaxo Laboratories, Ltd., Greenford, Middx., under the name of Cytamen. It will be remembered that the isolation of crystalline vitamin B_{12} from liver was achieved simultaneously last year by Dr. E. Lester Smith, senior biochemist of Glaxo Laboratories, and by an American team headed by Rickes. Cytamen is a practical result of that and the new knowledge gained in 18 months of intensive laboratory and clinical work.

Extensive clinical trials have established that vitamin B_{12} from streptomyces produces, on injection, all the known anti-anaemic and other effects of liver extract. It is also stated to have the same beneficial effect as liver extract on the degeneration of the spinal cord complicating some cases of pernicious anaemia.

The prime value of Cytamen is in making the treatment of pernicious and other macrocytic anaemias independent of supplies of liver.

WORLD POWER CONFERENCE

Programme for 1950 Meeting in London

WORLD Energy Resources and the Production of Power will be the theme of the Fourth World Power Conference to be held in London from Monday, July 10, to Saturday, July 15, next year. Programme and full particulars, together with instructions for attendance, have now been issued as a booklet printed in English and French.

The conference begins with an opening session at the Central Hall, Westminster, in the afternoon of Monday, July 10, and a reception by H.M. Government in the evening at the Science Museum, South Kensington. Technical sessions will be held each morning and afternoon up to and including Friday, July 14, in the buildings of the Institutions of Civil, Electrical and Mechanical Engineers.

On Tuesday evening (July 11) there will be a reception at the Guildhall, and an official banquet on Thursday evening (July 13).

The closing session will be on Saturday morning (July 15) in the building of the Institution of Civil Engineers.

A number of study tours has been arranged for the week following the conference. Itineraries have been arranged so that visits to places of historical and scenic interest are included as well as visits to industrial and other installations of purely technical concern. A number of day and half-day excursions from London have also been planned.

The technical programme has been divided into three main divisions: Energy Resources and Power Developments; Preparation of Fuels; and Production of Power.

In order that the time available may be available for discussion, papers will not be read at the conference but will be printed and distributed, and General Reporters appointed who will summarise the subjects and suggest subjects for discussion.

Altogether, 159 papers from 27 different countries have been announced, Great Britain contributing 23, the U.S.A. 20, and France 18. A full list of papers (corrected to October 27, 1949) is issued with the programme, and includes the following subjects:—

Belgium:	Underground Gasification.
Czechoslovakia:	A New Method of Thermally Controlling Coking Processes. Increasing the Output of Coke Oven Plants.
Great Britain:	A Review of Some British Carbonisation Problems; Use of Heavy Petroleum Fuels for the Production of Power; Preparation and Utilisation of Fuels from Coal Tar; The Recovery of Benzol at Gas Works and at Coke Ovens; Nuclear Fission.
Ireland:	The Winning and Utilisation of Peat.
Sweden:	Recent Development Possibilities by Means of Modern Retorts for Oil Shale and Modern Boilers for Shale Coke.
U.S.A.	Advances in Petroleum Refining; Synthetic Liquid Fuels; Transportation, Storage and Peak Load Supply of Natural Gas; Manufacture of Fuel and Synthesis Gas in the United States.

Chemical Exchanges with Japan

FRESH trade arrangements between Japan and countries in the sterling area have been put forward as a result of talks with the Supreme Command for the Allied Powers (SCAP).

Commodities to be purchased from the sterling area include rubber, salt, petroleum and tanning materials, while purchases from Japan will include chemicals, glassware and some electrical products.

Purchases by Japan from the sterling area countries concerned are expected to be worth approximately £55 million, and commodities from Japan may total £45.5 million during the 12 months July 1949 to June 1950.

Countries of the sterling area concerned are the United Kingdom and the Colonies (excluding Hong Kong); Australia, India, New Zealand and South Africa.

Chemical Employment

NUMBERS employed in the chemical and allied trades in Great Britain in September again showed a slight increase over the previous month.

Figures published in the latest issue of the *Ministry of Labour Gazette* show sectional distribution as follows:—

Industry	Thousands Sept. 1949	Aug. 1949	Mid. 1948
Coke ovens and by-product works	17.4	17.6	17.3
Chemicals and dyes	199.1	197.9	195.5
Pharmaceutical preparations etc.	34.3	33.8	30.8
Explosives and fireworks	36.9	36.2	33.8
Paint and varnish	38.1	38.1	37.0
Soap, candles, glycerine, etc.	49.0	49.0	46.9
Mineral oil refining	35.8	35.4	30.7
Other oils, greases, glue, etc.	30.4	30.3	28.9
Total chemical and allied trades	441.0	438.3	420.9

Basic Chemicals in September and October

Non-Ferrous Metal Stocks Improve

PRODUCTION of sulphuric acid materials in September showed all-round increase over the previous month and over September 1948. Consumption of liming materials was higher than in August and also greater than the same period last year. Stocks of non-ferrous metals were markedly higher than in 1948.

Another small increase occurred in the estimated numbers employed in all sections of the chemical and allied trades, totals for September being (in thousands) 441.0 compared with 438.3 in August. Distribution of workers in September was as follows: coke ovens, chemicals and dyes, explosives, etc., 253.4 (185.1 men, 68.3 women); paints and varnishes 38.1 (26.8 men, 11.3 women); oils, greases, glue, etc., 66.2 (52.6 men, 13.6 women); pharmaceutical, toilet preparations, etc., 83.3 (41.5 men, 41.8 women).

These figures and the table given below are abstracted from the latest issue of the *Monthly Digest of Statistics*, No. 47.

	September, 1949 Thousand Tons			September, 1948 Thousand Tons		
	Production	Consumption	Stocks	Production	Consumption	Stocks
Sulphuric acid	144.0*	140.0	—	131.3*	133.0	—
Sulphur	—	27.0*	175.2*	—	23.4*	72.5*
Pyrites	—	19.2*	67.0*	—	19.1*	63.0*
Spent oxide	—	16.2*	175.2*	—	16.7*	162.9*
Molasses (cane and beet)	11.7	25.9†	221.8	8.5	26.8†	197.5
Industrial alcohol (mil. bulk gal.)	1.91	2.27	3.91	1.87	2.11	9.43
Superphosphate	17.2	18.7	—	16.6	17.5	—
Compound fertiliser	162.8	143.2	—	151.2	126.2	—
Liming materials	—	546.7	—	—	367.6	—
Ammonia	—	6.17*	4.20	—	6.7*	5.44
Nitrogen content of nitrogenous fertilisers	19.79	22.61	—	19.64	21.5	—
Phosphate rock	—	84.9	255.3	—	80.4	193.2
Virgin aluminium	2.44	15.1	—	2.49	15.3	—
Virgin copper	—	31.0	145.2	—	31.7	123.2
Virgin zinc	—	18.4	73.9	—	20.0	55.7
Refined lead	—	19.4	63.4	—	21.4	18.6
Tin	—	2.09	23.5	—	2.3	16.6
Zinc concentrates	—	12.4	64.0	—	15.2	31.0
Magnesium	0.24	0.35	—	0.34	0.43	—
Pig iron	184.0*	—	506.0*	183.0*	—	281.0*
Steel ingots and castings (including alloys)	307.0*	—	1,331.0	297.0*	—	1,003.0
Rubber: Reclaimed	0.41	0.47	2.65	0.52	0.53	3.81
Natural (including latex)	—	3.73	47.4	—	4.08	63.4
Synthetic	—	0.05	1.45	—	0.05	2.13

* October. † Distilling only.

British Fertilisers Team Returns

THE fertilisers productivity team, which has been on a 6-weeks' tour of the U.S.A. (THE CHEMICAL AGE, *61*, 550 and 604) to study production methods, inspect plant and exchange information with representatives of the American industry, returns on the s.s. *Queen Mary* to-day (Saturday).

The team's complete itinerary, which included visits to a number of plants along the east coast and attendance at the autumn convention of the National Fertiliser Association, was as follows:

November 3-8: Conference with ECA officials and officials of the American Agricultural Chemical Company, New York, and Boyce-Thompson Institute of Plant Research, Yonkers, N.Y.; November 9: National Fertilizer Association, Washington; November 10 and 11: Tennessee Valley Authority, Florence, Ala.

November 14-16: National Fertilizer Association convention, Atlanta, Ga.; November 17: International Minerals & Chemical Corporation, Atlanta, Ga.; November 18: Empire State Chemical Company, Athens, Ga.; November 21; Georgia Fertilizer Company, Valdosta, Ga.

November 22-28: Swift & Co., International Minerals & Chemical Corporation and Gulf Fertilizer Company, Tampa, Fla.; November 29: Citrus Experiment Station, Lake Alfred, Fla.; November 30: Study of phosphate rock loading docks and handling facilities, Tampa and Boca Grande, Fla.

December 2: Virginia-Carolina Chemical Corporation, Richmond, Va.; December 5: Department of Agriculture, Beltsville station, Md.; December 6: Department of Agriculture, foreign agricultural relations division, Washington; December 7: University of Maryland, agricultural experimental station, College Park, Md.

December 8: Southern States Cooperative, Culpeper, Va.; December 9: Meeting with ECA officials and Press conference, Washington; December 12: Davison Chemical Corporation, Baltimore, Md.; December 13: American Agricultural Chemical Company, Carteret, N.J.

WATER POLLUTION LEGISLATION

Specialist Committee's Proposals for a New Act

CHANGES with far-reaching effects upon the safeguards which industries and other interests would be obliged to take to minimise the discharge of noxious material into streams and rivers are outlined in the publication newly issued by the Ministry of Health, "Prevention of River Pollution,"* which presents views and some of the evidence of a specialised committee, under the chairmanship of Mr. S. R. Hobday, which has studied the subject at 33 meetings since its appointment in June 1946.

The committee's appreciation of the water pollution from all sources to-day is evidenced by its comment that "The need for the improvement of the condition of rivers and streams in many parts of the country can hardly be exaggerated". Much of that deterioration, it is said, is of recent origin.

The proceedings appear to have given appropriate weight to the predominant influence of sewage outflow in most instances of water pollution and to the heavy flow of mine water in some areas. The latter intractable phase of the work is likely to be the subject of further discussion with the National Coal Board.

A Fresh Start

All the committee's recommendations are framed to strengthen the effectiveness of the River Boards, which are to be set up under the authority of the River Boards Act, 1948, and which will be the regulating authorities for nearly all purposes. To do that effectively, the committee considers that a new Act of Parliament is essential, rather than a series of amendments of the Rivers Pollution Prevention Act of 1876, many of whose provisions are anachronistic. It is not proposed that the legislation contained in the subsequent Acts should in general be amended. That, too, will be administered by the River Boards.

The committee's report sets out the principal respects in which existing legislation affecting the subject should be changed in a new Act and has a number of subsidiary proposals, many of which would confer comparatively wide powers on the River Boards to frame byelaws.

* Prevention of River Pollution (Report of the Rivers Pollution Sub-Committee of the Central Advisory Water Committee appointed by the Minister of Health). HMSO, 1s. 6d.

The following are the principal changes recommended:—

The separate provisions relating to sewage pollution and industrial pollution should be replaced by a comprehensive provision making it an offence to allow offensive or injurious matter, solid or fluid, to enter a stream. The separate provisions in Section 5 for prevention of pollution from mines should not be continued, but the reservation relating to mine water which enters a stream in the same condition as that in which it has been drained or raised from the mine should be retained pending technical investigation.

The provisions in Sections 3 and 4 of the Act relating to discharge through a channel, etc., in existence at the date of the passing of the Act, or through a substituted channel with an outfall at the same spot, should be repealed.

Standard of Effluents

A River Board should be able to prescribe standards with which effluents discharged into a stream or part of a stream must comply; effluents which do not comply with a standard should be deemed to be offensive or injurious.

The standards should be prescribed by byelaws subject to confirmation by the Minister of Health, and the procedure for making byelaws should be that laid down in Sections 18 and 34 of the Act of 1948, with the following modifications.—

(a) Three months' notice should be required of a proposal to submit byelaws for confirmation;

(b) the Minister should be required to hold a local inquiry if objections to confirmation of byelaws are received from persons he considers to be interested.

Compliance with a standard should be a defence against proceedings under Section 8 of the Act of 1923. A byelaw fixing a standard should not be confirmed until a proper survey of the stream or part of a stream has been completed. A River Board should be required to submit to the Minister of Health a report of any completed survey of a stream of part of a stream.

A River Board should be able to take proceedings in respect of polluting matter which does not reach a prescribed standard, without consent of the Minister of Health.

Proceedings should not be taken, with-

out the consent of the Minister of Health, in respect of liquid effluent from industrial, manufacturing and mining undertakings if no standard has been prescribed for the stream, or if the proceedings are in respect of properties of an effluent for which no standards are prescribed.

The Minister should be required, before giving his consent to proceedings, to consider whether the best practicable means of treatment, within a reasonable cost, are being used; if they are not being used, he should (if he thinks it reasonable) give the person concerned an opportunity of obtaining and using them.

New Outfalls

It should be an offence to open into a stream any sewer, drain, etc., unless the consent of the River Board has been obtained; the Board should be entitled to attach terms and conditions to their consent: consent should not be unreasonably withheld and any difference on a question whether consent should be granted, or whether the conditions imposed are reasonable, should be determined by the Minister of Health. That provision would not apply to the Manchester Ship Canal.

Consent should not be required to a new opening for the discharge of effluent from the sewage disposal works of a local authority if the work has been approved or authorised by the Minister, or if he has consented to a loan to meet the cost.

Four weeks' notice should be given to the River Board of any proposals which involve radical changes in the volume, nature or rate of discharge of any liquid effluent being discharged into a stream.

The provisions relating to solid matter should deal with all solid matter except offensive or injurious matter which would be within the scope of the provision proposed in the first recommendation. They should follow in principle Section 43 of the Act of 1938, and should also prohibit the placing of offensive or injurious matter on the banks of a stream so that it may drain or pass into the river.

Because of the impracticability of avoiding the spilling of spoil into waterways in some mining areas, partial exemption of mines and quarries from the effect of this provision is proposed.

The provisions dealing with solid matter should not relate to suspended solid matter, unless the Court is satisfied that the suspended matter which has been allowed to pass into a stream is obstructing or is likely to obstruct the due flow of the stream.

Full powers for the prevention of river pollution should apply to tidal waters only where so determined by order of the Minister of Health, after a local inquiry. The Minister, in exercising this power, should not be restricted to "sanitary grounds" but should be able to take any relevant circumstances into consideration. He should have an additional power, by order, and after local inquiry, to extend particular provisions of the law to tidal waters.

Parliamentary Topics

THE Under Secretary of State for Foreign Affairs (Mr. C. P. Mayhew), replying to Mr. W. Fletcher, affirmed that Western Germany will not be permitted to make synthetic rubber, although the factories concerned had not been dismantled.

SULPHURIC acid purchases by the Government were the subject of questions in the House of Commons last week. In reply to Mr. J. Boyd-Carpenter, the President of the Board of Trade (Mr. Harold Wilson) said that the exemption of such purchases from price control was only to cover research establishments in areas where there were no other consumers on the basis of which it would be possible to fix a fair price. Mr. W. S. Shepherd asked whether the difference in price was not, in fact, caused only by variations in the cost of delivery.

IN a written reply to Mr. Raymond Blackburn concerning atmospheric pollution, the Minister of Health (Mr. A. Bevan) said that eight local authorities had taken powers to establish smokeless zones, 17 to control the emission of smoke from new furnaces and 18 to provide district heating, and the City of London had taken power to extend its by-laws for regulating smoke. The Minister said that he had asked all local authorities to select types of appliances that burnt smokeless fuel for installation in new houses, and that he had approved a number of experimental district heating schemes.

REFERRING to the report of the Water Softening Sub-Committee, the Minister of Health, in a written answer to Mr. H. A. Nutting, stated that it was not possible at present to divert labour and materials to water softening projects, though he was prepared to consider any schemes that might be submitted to him in general.

NATURAL GAS IN SOUTH-WEST FRANCE

Industrial Applications Saving Dollar Imports

EXPLOITATION of oil and natural gas resources in South-West France, notably in the Montpellier and Saint-Marcet regions, is now engaging the attention of some important oil concerns. Initial development work was undertaken before the war and, at present, three companies are known to be exploiting some 8.5 million acres. The companies are: Régie autonome des Petroles, Soc. nat. des Pétroles d'Aquitaine, and Soc. nat. des Pétroles du Languedoc méditerranéen. All are collaborating closely with the Service de Recherches de Pétrole en France. A fourth company—Standard français de Pétroles—has lately requested exclusive rights over large areas in the La Rochelle, Cognac, and Biscarosse regions.

A fairly complete record by M. Marcel Turon, of developments in this part of France, is reproduced in part in the French review *Etude et Conjoncture* (1949, 4 (2), 63-96). They also form the subject of a detailed and well illustrated study by Georges Génin, entitled "Les gaz naturels de Saint-Marcet et leur utilisation" in *Chim. et Ind.* (1949, *62*, 503-509).

Vast Reserves Possible

Most substantial progress appears to have been made by the first named company, the R.A.P., from nine borings in the Saint-Marcet and Proupiary districts, at least one of which yields petroleum as well as gas. The latter is nearly pure methane (about 92 per cent) with some ethane and other paraffins, and nitrogen. Yields at 15°C. and 750 mm. pressure have increased from 9 million cu. m. in 1942 to 174 million in 1948. The latter figure is by no means the maximum possible, for it is limited by transport facilities and other factors. Total probable reserves are difficult to estimate, but a figure of 7000 million cu. m. has been given by specialists.

The gas undergoes double treatment, first to recover the liquid hydrocarbons—butane, etc.—and then a petrol removal or total elimination of condensible constituents. This double recovery enabled about 730 tons per month of finished products to be sold in 1947. The gas may be used directly as domestic or industrial fuel, as a substitute for petrol, and in various syntheses.

In the first category—domestic or town gas—the high calorific power (9500) as compared with 4500 for coal gas, requires that suitable domestic apparatus should be provided, or that the gas be modified to suit existing apparatus, as, for example, by admixture with gas of lower calorific power. It is thus possible to obtain a whole range of gas mixtures approximating that of coal gas and with a calorific range from 2000 to 9000. By using some of these methods in French towns a great saving in imported fuel has been effected, estimated at $2.16 million.

Adopting Gas

In the industrial category, many steel works, paper works, distilleries, ceramic, fertiliser and other factories, etc., are gradually replacing existing plant with gas heating for steam raising or other purposes. In many steam plants efficiency of boilers increased by 50-80 per cent, and production capacity by at least 30 per cent. These advantages are particularly marked with Martin steel plant and furnaces and the absence of sulphur in the gas is a very favourable factor in the production of special steels.

In 1947 nearly 60 million cu. ft. was sold to local industry, and receipts rose to Fr.213 million. Average price in 1947 rose from Fr.3.37 to Fr.5.32; 118,000 tons of coal was saved, equivalent to $2,124,000.

Natural gas in pressure cylinders is also being increasingly used for heavy motor vehicles. It has certain advantages, such as a high octane number (125) allowing a compression ratio of 15. In 1947, 32 million cu. m. were sold, replacing petrol to the value of $2.1 million. A total saving of about $7 million, representing 18 per cent of crude oil imports from the U.S.A., has thus been effected. Imports will be further reduced when the Saint-Marcet output is increased to 1 million cu. m. per day.

The economics of the different uses for natural gas in France, which include the manufacture of hydrogen, is discussed and a price policy considered.

In conclusion, the respective amounts of power available per head of population in the U.S.A. (15,000 kW) and in France (1900 kW) are compared. There is thus plenty of scope in France economically to increase available power supplies.

SCIENTIFIC MANPOWER

Survey of Supply and Demand for Chemists

THE present and future demand for and supply of the professionally qualified scientists and technologists who will be needed in Government service, industry, research and teaching over the next five years, and the numbers of people likely to be available who could be trained, have been surveyed in five reports just published by the Ministry of Labour and National Service.

The report devoted to the profession of chemistry states that, in comparison with 1938-39, the number of full-time students reading pure science for a degree has more than doubled in the session 1948-49. In estimating the future demands for chemists, the sub-committee on chemistry of Lord Hankey's technical personnel committee agreed that the minimum standard that should be considered would be "chemistry taken as a finals subject for a first degree in science."

Probable Normal Recruitment

We recognise, states the sub-committee's report, that any survey such as we have carried out can be neither exhaustive nor precise. The estimates discussed are based on probable normal recruitment. This may be fundamentally altered by changes in the industrial situation. It is emphasised by the University Grants Committee that the great increase in the student population clearly calls for something like a corresponding increase in the number of staff, and that there is also a general sense that the ratio of staff to students ought to be improved. The full implications of doubling the number of science graduates as advocated by the Barlow Committee are not always appreciated.

We recognise that the adequate staffing of departments of chemistry in the universities and university colleges is vital if the quality of the training for chemists is to be maintained. Moreover, as most of the future demands for chemists assume that there will be a large extension of facilities for post-graduate research, there must be a full appreciation of this fact when priorities in the allocation of labour and materials are under discussion for university buildings. Also the Barlow Committee did not overlook the technical colleges and institutes as an important source of supply of scientists, and it may well be that in the future many young scientists will secure their qualification by full-time attendance at these.

It is apparent that the employment of chemists in industry is not restricted to essentially scientific work and that industry can provide employment for many types of chemical graduate in which academic qualifications, general ability and good personality are all of importance. It also appears that the number of graduates in chemistry not acceptable to industry nowadays is relatively small and consists of men with mediocre academic qualifications combined with lack of personal qualities.

The report deals at length (page 829, this issue) with the encouragement which the sub-committee suggests is given to too many young men undertaking post-graduate training to regard research in pure science as the only worth-while career for a chemist.

On the shortage of well-trained chemists, the report states, there seems to be general agreement that recruitment is especially difficult in the fields of physical chemistry, biochemistry and specialised analytical chemistry. It is felt that many potential physical chemists are deterred from taking up this subject because they lack the basic training in mathematical subjects which is required. It is suggested that the drawing up of a syllabus in mathematics and physics necessary for a career in chemistry would be of great value to both schools and universities.

Analysts

We (the sub-committee) share the concern of Government departments and industry at the scarcity of chemists having training and ability to deal with the analytical problems of modern science. During the last two or three decades the status of the analyst has fallen and the belief has grown up that the post of analyst can be filled by the unadventurous and the uninspired. As a result there is a great dearth of suitable men and women analysts.

There is a need for chemists and physicists of the highest calibre to plan the application of modern analytical techniques to the problems arising in research or production departments and to develop new methods. The revival of interest in this subject in the universities is a matter of urgency, and equality of status and

opportunity should exist in industry between chemists or physicists engaged in this work and chemists engaged on any other type of work.

The University Grants Committee has submitted details of the output of honours graduates in pure or applied chemistry over the next few years, and we agree that the probable output would be of the order of 900 graduates per annum, of whom 60 per cent would qualify for a good honours degree. In addition, there must be added the honours graduates from schools of chemistry outside the scope of the University Grants Committee, and we estimate these at 125 per annum. Also, of those who will graduate each year with chemistry as part of a pass degree, it may be expected that at least 400 will be prepared to take up a career in chemistry.

A considerable number of students of chemistry attain their professional qualification by taking the examinations of the Royal Institute of Chemistry. In 1948, the number of candidates examined was 287, of whom 123 passed. The supply position, from all sources, may, therefore, be summarised as follows.—

	Nos. each year over next 5 years
Honours graduates	1,025
Pass graduates	400
A.R.I.C.	125
Total	1,550

All this adds up to a grand total supply over the five years of 7750.

Industries Employing Chemists

On the subject of demand for chemists the report deals with industry under two main heads—the chemical industry itself and all other industries employing chemists.

The chemical industry is not one industry but innumerable industries which are all linked by the fact that they are based on the science of chemistry. Unfortunately, there is no generally accepted definition as to the constitution of the chemical industry so that its scope varies from country to country. Some idea of the range of industries in the grouping of chemical industries is given in the following list, which is classified according to the method used by the Association of British Chemical Manufacturers:—

Group A. Heavy chemicals—all inorganic acids, alkalis and other heavy chemicals, including fertilisers.

Group B. Fine chemicals—medicinal, pharmaceutical and allied; laboratory; photographic; rare earth; synthetic aromatics, perfume, isolates and their derivatives and allied; technical; acetone, alcohols, ethers and their derivatives; solvents and plasticisers.

Group C. Coal tar distillation products, excluding ammonia and ammonia products.

Group D. Dyestuffs and explosives and their intermediates.

Group E. Fats; glycerine; greases; soaps.

Group F. Pest control products—disinfectants; insecticides; sheep and cattle dips; veterinary medicines.

Group G. Other chemicals and allied products and industries, including gelatines, glues and sizes; plastics; paints, varnishes, enamels, lacquers; resins, tanning material not elsewhere covered; oil distillation products.

Consulting Chemists

In considering the position of the chemist in industry it will be apparent that under modern conditions the chemist finds employment in a wide range of industrial activities outside what we have defined above as the chemical industry. For example, the metallurgical industries, the petroleum industry and activities associated with the supply of food and drink, textiles and clothing, employ a large number of chemists in a variety of posts. Industry also calls to its aid the consulting chemist and the consulting anaiyst.

In assessing the probable demands of industry, therefore, the first task is to estimate how many chemists are normally employed both in the chemical industry itself and in other industries. In a recent survey of scientific man-power undertaken by the Ministry of Labour and National Service the replies to questionnaires completed by individual scientists indicated that some 12,000 chemists were in industrial employment. This figure is supported by other considerations.

From an examination of the particulars given in the list of members of the Royal Institute of Chemistry, we concluded that as many industrial chemists were employed outside the chemical industry as within it. We have ascertained that some 166 firms in the Association of British Chemical Manufacturers employ 5400 chemists and that this includes the large concerns. To suppose that the 56 firms who did not reply to the questionnaire employ about 600 chemists seems a not

unlikely assumption, whereby we conclude that approximately 6000 chemists are in posts in chemical industry and 6000 chemists are employed in industries outside. The next necessity is information on which to form estimates of the probable future intake of chemists to replace wastage, to make good deficiencies in present establishments and to permit any expansion which is planned in the chemical industry and in other industries.

Help from ABCM

The director and secretary of the Association of British Chemical Manufacturers gave us most valuable assistance by sending to its members a questionnaire. The number of firms receiving this communication was 222 and replies were received from 166 firms. The 166 replies included all the major chemical firms. An analysis of the data which were supplied in answers to the questionnaire is given below :—

(1) Number of chemists employed in 1948 by 166 firms.

(*a*) Research	1,961
(*b*) Development	620
(*c*) Production including process control	1,671
(*d*) Technical sales	363
(*e*) Administration	459
(*f*) Others	288
	5,362

(2) Estimate of number of chemists to be employed in 1953.

(*a*) Research	2,721
(*b*) Development	1,079
(*c*) Production including process control	2,442
(*d*) Technical sales	461
(*e*) Administration	522
(*f*) Others	264
	7,489

(Sixteen firms answering the questionnaire stated they were unable to estimate their requirements in 1953. In these cases the figures for 1953 are taken as being the same as for 1948 and the 1953 figures will be, therefore, an underestimate.)

The figures show that the number of chemists to be employed by the selected firms should increase during the next five years by some 40 per cent. If we apply this percentage increase over the whole field of the chemical industry, *i.e.*, 6000, it follows that the number of chemists employed in the chemical industry may be expected to expand over the next five years by some such figure as 2400, *i.e.*, the numbers whom this industry will wish to employ will increase from 6000 to 8400.

If we assume, as was done in the Barlow report, that the scientist spends 30 years in active work, then over five years approximately 1000 new chemists will have to be taken on to replace wastage in the chemical industry. Adding this to the " expansion " figure above, we get a need for new chemists in the chemical industry over the next five years totalling 3400.

Turning to the needs of other industries, it is necessary for our purposes to subdivide the firms into those in industries for which there are research establishments and those in industries without such establishments. In regard to the former, we find, basing ourselves on information obtained from a sample inquiry, that whereas firms in this category and their research associations have at present a staff of 3140 chemists, they hope over the next five years to increase this number by 60 per cent, which works out in round figures at an increase of 2000. The other firms (*i.e.*, those not connected with research associations) at present employ approximately 3000 chemists. No estimates are available about probable expansion in this sphere. It would seem, however, that it would be wrong, in the light of the foregoing, not to assume some expansion in this sphere also. A figure of 20 per cent is not unlikely, and this would mean an extra 600 men.

If we make the same assumption on wastage as we made in regard to the chemical industry, we have once again to provide, over the five years' period, for 1000 new recruits to make good normal wastage in those industries (other than the chemical industry itself) which employ chemists. This, added to the " expansion " figures as estimated in the previous paragraph (2000 and 600) produces a grand total in this sphere of 3600.

Estimated Needs

To summarise the position in a table, the estimated needs of industry for new chemists over the next five years can be set out as follows :—

To replace estimated wastage (chemical industry and other industries employing chemists)	2,000
To provide for estimated expansion in the chemical industry	2,400
To provide for estimated expansion in other industries	2,600
	7,000

The replies to the questionnaire received from members of the ABCM gave interesting information on the need for men with different qualifications. 136 out of the 166 firms gave estimates of their requirements for chemists with first or second class honours degrees. For the year 1953, these would amount to 1700 chemists out of a total of 7500 chemists it is hoped to employ. This emphasises that there is a

place within the industry for a man with academic qualifications other than a first or second class honours degree. At the same time it must be pointed out that this ratio of first and second class honours men to the chemists with lower qualifications is very different from that given to the sub-committee by representatives of some of the larger firms.

For example, in one large firm it was estimated that on the research side of the organisation the distribution was: First and second class honours 83 per cent; third class honours and pass degrees 17 per cent. In the works the distribution was: First and second class honours 78 per cent; third class honours and pass degrees 22 per cent.

An analysis of the academic qualifications of chemists employed by a large oil company may also be quoted

	1st or 2nd Class Hons.	Ord.
Research and development ...	132	10
Production	70	9
Technical administration ...	46	12
Sales service/Techno-commercial	34	15
Sales (including export) ...	3	—
Divisional directors and executive staff	32	—
Education	2	—
Staff and labour	1	—
Total	320	46

The Physicist in Industry

Insufficient Interest in the Fundamentals

ONLY in recent years have opportunities for physicists in industry been reasonably fully developed. This is one of the conclusions reached in the report on "Present and Future Supply and Demand for Persons with Professional Qualifications in Physics," prepared by a physicists' sub-committee of the Technical Personnel Committee for the Ministry of Labour. The report represents the only generally available summary of facts relating to numbers employed, requirements of particular industries, etc.

A limited number of good men is needed for industrial research. Shortage of men of the right type interested in classical physics (such as thermodynamics and optics) is particularly noticed, and it is recommended that this essential department should not be allowed to suffer because of the greater modern appeal of atomic and nuclear physics.

There is a larger demand for physicist-engineers, the report observes—men with a physics degree who also have the practical outlook of the engineer and are keenly interested in applying their knowledge of physics to industrial problems.

Grants for Training

Men who wish to enter industry and have no special aptitude for original research should be encouraged to obtain additional training in some branch of engineering or technology.

This training might well consist of a further year's course in the appropriate branch and arrangements should be made for grants to be available to men who take such a course.

Alternatively, the training could take place in industry, in a form comparable with the graduate apprenticeship of an engineer although of shorter duration.

In making forecasts of future requirements there are many factors beyond the control of the organisations which have supplied the sub-committee with information.

The most obvious of these is the undoubted effect which changes in the general economic situation of the country would have on the estimates. There is evidence that the shortage of physical space in laboratories and workshops is to some extent restricting the number of new staff which can be engaged and the building programme may therefore have its effect on requirements.

Future Needs

At this stage it is not possible to assess the extent to which new developments such as the introduction of electronic control equipment will affect the demand for physicists, and the use of operational research methods may, if it becomes widespread, make an additional call on scientific manpower.

There is a number of posts on the borderline between physics and other subjects, such as mathematics, engineering and chemistry, for which it is difficult to decide whether a physicist is required or another scientist, or a man qualified in more than one subject. In making our estimates, we have done all that is possible to take account of this.

The report provides in tabular form a summary of requirements from all sources:—

(*continued overleaf*)

AVERAGE ANNUAL DEMANDS FOR PHYSICISTS

	1948–50	1951–55	1956 onwards
Industry ...	250	250 decreasing to 150	150
Research assns.	30	30 decreasing to 20	20
Government depts. ...	175	50	50
Teaching ...	350	350	225
Universities ...	20	20	20
	825	700 decreasing to 590	465
Misc. 5% ...	40	30	25
Total ...	865	730 decreasing to 620	490

It would appear that during the next few years the supply of physicists is likely to be rather less than the demand; this slight shortage may continue for about five years although the difference between supply and demand becomes progressively smaller until it is clear that after 1952 there is a possibility of over-supply of physicists.

A purely quantitative assessment of the position may, however, prove misleading and it is essential that quality must be borne in mind when comparing figures for supply and demand.

There is a number of highly intelligent men and women who reach the standards set for entry to a university, but who find that the advanced work in the final parts of their courses is beyond their powers, the report continues. They only achieve a place in the lower grades of the honours finals, or perhaps graduate with a pass degree.

At the same time they often possess valuable personal qualities and abilities in spheres other than the purely academic. There are many posts which this type of person could fill satisfactorily and possibly with greater success than some of the men who obtain high honours.

These facts do not seem to be sufficiently appreciated, and there is evidence that it is becoming habitual for some employers and Government Departments to insist on first or second class honours degrees for any posts for which they require a physicist.

If this persists, there is a danger that the standards at present maintained in final examinations may tend to be lowered.

We feel strongly that any reduction in this standard would be deplorable. It is for these reasons that all employers should realise the danger of over-emphasis on academic standard, and a good honours degree should not be stated as essential for posts for which this qualification is not really essential.

Twenty-nine More Candidate Chemical Engineers

A SUBSTANTIAL increase in the number of candidates for the associate membership examination of the Institution of Chemical Engineers—of 29 to a total of 115—is recorded in the examiners' report. Fifty-six sat for the full examination and 39 took only the home papers. Twenty were concerned only with subjects in which they had failed previously.

Of the total, 61 were successful (53 per cent), 23 in the full examination, 28 in home papers and 10 in particular subjects.

The examiners' report, while it recognises that the examination represents a severe test of understanding of fundamental principles, capacity for orderly treatment and hard work, suggests that the percentage of passes (4 per cent fewer than in 1948) reflects a slight lowering of candidates' ability. There were some outstandingly good papers, but fewer than in most previous years. They note, for example, that papers C, D and E disclosed that many candidates had learned formulae without understanding the fundamental bases, so that some were incapable of performing a simple calculation in an unfamiliar form.

The successful entrants were:—

Henry Andrew ANSON, Frederick Stanley BEARDMORE, Albert BOOTH, John McNicol BRUCE, Jack William BRUCE, Austin George CARTER, Philip Victor Charles COLEBROOK, Derrick Gwynn CROXON, Roy Vernon CULVER, Egidius Franciscus du MAINE, Kenneth Clarke FISHER, Hugh John FOXCROFT, Donald Cole FRESHWATER, Raymond Douglas GARMANY, Alan Crofton GODFREY, Cyril GREEN, Joseph John GRIFFITHS, William Frederick HARRIS, Harry Ronald HEWITT, Walter Howard HUSBAND, Philip Penry JONES, Bernard George LIMMER, Leslie George LUDLOW, Aric Lavinus LUY, Alan Bruce McKELVIE, Ivan Morris MADDERN, John Herbert MERCER, John Desmond MITCHELL, Cecil Denis Bradley MOON, Donald Roland NEALE, Alan Hedley NORRIS, Derek John OLIVER, James OWEN, Ronald PARKER, Malcolm PEARCE, Denis Arthur POLKINHORNE, John Scott POLLARD, Edmund POULSOM, David Elwyn ROBERTS, Sydney Albert ROBINSON, Leslie David ROLAND, Kenneth Evans SCANLON, Michael SHAW, Eric SHORT, Robert Hall SIMPSON, Harold Aitken SLADE, Sydney Ernest SMITH, Henry Joseph Maxwell STEPHENSON, Brian Edward Alston THOMAS, Jack THOMPSON, Peter Arnold TOYNBEE, Dirk van BLADEREN, Jan van OORSCHOT, David Sweetnam VICKERY, Norman Ernest WARD, Geoffrey WATERHOUSE, Richard John WAUGH, Alfred Wilfred WEBB, Ivor Norman WELLINGS, Gerald Douglas WILLIAMS, James Bryan Lonsdale WORTHINGTON.

STANDARDISED LABORATORY PRACTICE

Safeguarding Chemical and Control Tests

CONTROL tests to ensure uniformity in making tests and the manner of expressing results when dealing with boiler water treatment have been summarised and issued as B.S. 1427.

The standard has been divided into three groups covering tests for water used in steam generation. The first group, A, is now available and can be used where no laboratory facilities are available.

The tests have been sub-divided to cover raw water, softened water, condensates and boiler water, and give detailed methods for the following determinations:—

Appearance, density, electrical conductivity, *p*H value, free carbon dioxide, alkalinities, total and ghost point hardness (Wanklyn method), alkaline hardness, non-alkaline hardness, calcium, magnesium, chloride, dissolved solids, phosphate, silica, copper, free chlorine, oil, sulphate, sulphite, dissolved oxygen, free and saline ammonia, aluminium, iron (dissolved, suspended and total).

Appendices are also included, giving information on the preparation of indicators and standard volumetric solutions, with tables of abbreviations, equivalents and conversion factors.

Cast iron pipe flanges and flanged fittings for the petroleum industry, class 125 and 250 are the subject of British Standards 1575 and 1576, now available. Both these have been prepared with special consideration of the American Standards Association requirements.

Details are given for the design and construction of flanges and flanged fittings and tables provided with all the necessary dimensions.

Conversion Tables

Another new issue by the British Standards Institution is addendum No. 1 to British Standard 350: 1944.

This contains additional definitions, conversion factors, multiples and tables relating to cubic measures, weights, pressures, force, concentration, and traffic units. A set of factors and multiples and a few extended tables for the conversion of units of thermal conductivity and conductance, heat flow and viscosity, are also included.

Attention is directed to the use which can be made of many of the basic tables, included in B.S. 350: 1944, for the conversion of derived units. All the tables provide for two-way conversions.

At the request of users of B.S. 350, the addendum contains an index of the definitions, factors, and tables included in the two books.

Dangerous Reagents

The necessity for special precautions in the use of laboratory chemicals when carrying out analysis of iron and steel (B.S. 1121, parts 15 and 16) has prompted the British Standards Institution to publish a special standard, "Safety Precautions in the Use of Laboratory Chemicals for Metallurgical Analysis."

One of a series, it is intended to provide that working conditions and procedure in laboratories will minimise the danger of serious accidents, and to act as a medium of instruction in the safe handling of laboratory chemicals.

The standard (B.S. 1121A) will be issued in several sections, the sequence following, as far as possible, the use of particular reagents in B.S.1121. The first two sections now available cover general requirements and precautions in the handling of perchloric acid.

General requirements are divided into nine sub-headings dealing with cleanliness, storage, protection of workers, ventilation and neutralising agents. Fume cupboards, ducts and other structural work play an important part.

Attention is drawn to the customary precautions in fuming, the quantity of the reagent used in analytical work, protective garments and other means of preventing accidents.

Chemical Balances

AT a recent two-day meeting, held by L. Oertling, Ltd., manufacturers of balances and weights, at its head offices, 110 Gloucester Place, Portman Square, London, W.1, to which had been invited all area service representatives, works personnel and sales staff, the chairman, Mr. J. Rock Cooper, expressed his appreciation of the close liaison maintained with the men "in the field." He emphasised it was only by a proper understanding of chemists' needs and difficulties that the design staff could produce balances of the required performance.

Microscope and Diffraction Studies of Soaps

Fresh Light on Modern Problems of Detergency

From A SPECIAL CORRESPONDENT

ELECTRON microscope and X-ray diffraction studies of soaps, carried on recently at the U.S. National Bureau of Standards, have revealed for each type of soap molecule characteristic features that can be used for its identification and analysis. The electron microscope also indicates the individual soap forms that are present in a mixture, such as a commercial soap prepared from mixed fats or oils; this is not always possible with the X-ray spectrometer because of the nature of the diffraction patterns obtained.

Measuring Effectiveness

When considered in conjunction with physico-chemical measurements of aqueous soap solutions, these data offer an explanation of the mechanical process of cleansing, and at the same time suggest a basis for evaluating the cleansing power of the different types of soap.

Although soaps and other kinds of cleaning materials have been in common use for centuries, there are no universally accepted quantitative methods for determining their washing or cleansing power. Extensive data are available in the literature on the structural and phase behaviour of pure alkali soaps in the solid state, as well as on the physico-chemical characteristics of their aqueous solutions.

Soaps and the newer synthetic soapless detergents, however, are in many cases bought only on the basis of appearance and texture; the quantity of suds they produce; and, with some critical purchasers, their action on the skin and hands.

The present investigation was conducted by Gopal S. Hattiangdi, in co-operation with members of the surface chemistry and the constitution and microstructure laboratories at the National Bureau of Standards, to apply some of the newer scientific techniques to the problem.

Commercial soaps contain, for the most part, the sodium or potassium salts of the higher fatty acids. Small amounts of inorganic salts, organic compounds, and other additives may also be present to enhance some special property of the product.

The synthetic detergents, on the other hand, are mostly soapless compounds obtained by the sulphonation, sulphation, or similar treatment of various types of organic molecules.

A total of 30 typical commercial soaps (toilet, medicated, glycerin, coco, washing or laundry, and shaving varieties) and six popular synthetic soapless detergents were included in the investigation. In addition, for the electron microscope and X-ray diffraction studies, a number of pure soaps were prepared directly from their fatty acids.

The differences in structural arrangements between soaps and between soap phases may be determined by examining surface details. Several previous investigators have used the polarising microscope at about 200 to 400 magnifications as a valuable adjunct to visual observations. The electron microscope, with its high resolving power (approx. 100 Å), has been used with considerable success in recent years to examine the surface details and structure of a variety of systems and, in conjunction with the metallic-shadowing technique, yields additional significant information.

The approach to the present study was to obtain first the morphological differences between several pure alkali soaps and then to examine the possibility of characterising commercial soaps on the basis of these observations.

Electron Micrographs

The most characteristic feature of the electron micrographs for the pure soap is an interlocked mesh of fibre bundles of varying diameters and different degrees of twist but with a general tendency toward retaining both a criss-cross and a parallel structure. The diameters of the soap fibres depend upon the nature of the soap, concentration, rate of crystallisation, and other factors. Consequently no measurements and interpretations in terms of absolute units were made.

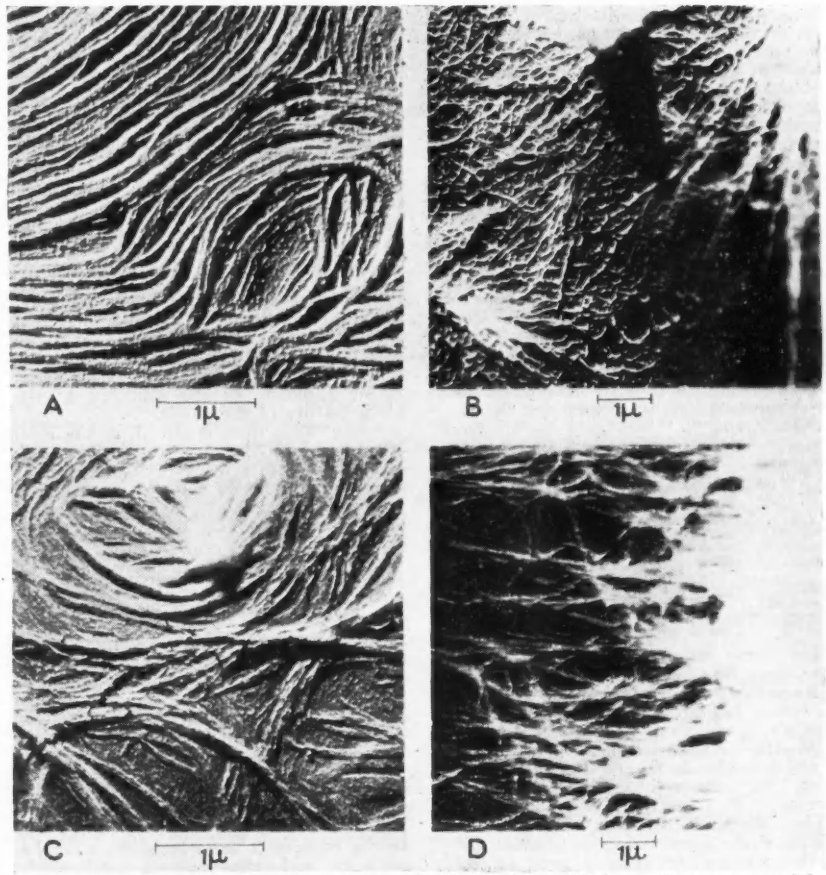
An attempt has been made, however, to represent schematically the growth of fibres and fibre bundles in terms of molecular packing. Packing of the soap molecules end to end, probably a minimum of ten, determines the "width" of the fibres. The association of the soap molecules in a direction perpendicular to the long axis of the soap molecules, but in the plane of the hydrocarbon chains, takes

place almost indefinitely and results in the "length" of the soap fibre.

The "height," or "thickness," of the fibre depends upon the number of soap molecules packed in a direction perpendicular to the plane of the carbon atoms but parallel to the long axis of the soap molecules.

Another outstanding characteristic revealed by the electron microscope is that each pure soap exhibits unique and distinct features, such as a curdy mass, an octopan mass, or filamentous, hairy, frond-like, or sheaf-like formations. These are probably the result of a type of structural unit, such as a micella grouping within the soap fibres.

Whatever the interpretation, these patterns serve as excellent guides for a quick characterisation of the pure alkali and for the identification of the components of commercial soaps of unknown composition. Thus, electron micrographs for the toilet soaps reveal distinct forms for both sodium palmitate and sodium oleate. The shaving soaps are characterised by forms typical of sodium palmitate. The laundry (washing) soaps exhibit forms that cannot be definitely identified with those for any of the



A and B are pure alkali soaps (oleate and palmitate); C and D are their commercial counterparts

pure soaps that have been investigated.

X-ray diffraction patterns were also obtained with a Geiger-Müller X-ray spectrometer in order to determine the molecular arrangements or phases present in commercial soaps. When a beam of X-rays is directed at an oblique angle against a soap surface, most of it is reflected at the same angle, but a few rays are diffracted at other angles. The intensity of the diffracted X-ray as a function of the angle at which they occur depends upon the manner in which the soap molecules are arranged. The impulses on the Geiger tube were transmitted to a strip-chart potentiometer so that the desired data were recorded automatically.

A crystalline soap phase, well developed in three dimensions (a, b, and c axes), exhibits a sharp, rather intense long spacing and several short spacings, which are well defined and lead to sharp peaks in the X-ray diffraction pattern. The sharpness of the long and short spacings observed for the various commercial soap patterns therefore indicates that they are all crystalline.

Constituents

X-ray diffraction data have also been used to identify the various phases present in the commercial soaps on the basis of published values of both the long and short spacings for numerous phases of pure sodium laurate, myristate, palmitate, stearate, and oleate. The approximate degree of hydration, based on water (moisture) content, has been computed for the various soaps.

Type of commercial soap	Phases	Degree of hydration
Toilet	Mostly beta sodium palmitate; some omega sodium oleate.	moles of water 0.5 to 1
Medicated	Same as above.	0.5 to 1.
Glycerin	Indefinite.	Indefinite.
Coco	Omega sodium laurate and sodium myristate.	2.
Laundry (washing)	Omega phase; soap indefinite.	Indefinite.
Shaving	2 or more phases of sodium palmitate.	1.

The X-ray diffraction data can be further used to depict the nature of molecular packing in soap crystals. This may be stated briefly as being an end-to-end packing of the soap molecules, the perpendicular between two consecutive layers of the polar heads (containing the cation) being the observed value of the long spacing.

The distance between hydrocarbon chains of the soap molecules is evidenced as the strong short spacing peak around 4.1 Å. Shorter distances, such as those between carbon atoms in a given soap molecule, may be computed from the values of the relatively weak short spacings exhibited in the region of 2.5 Å.

The packing usually takes place with the soap molecules slightly tilted and the angle of tilt, β, can be determined because the true length of the molecules can be calculated from known values of bond angles, bond distances, and atomic radii. The value of β varies from soap to soap and also from one phase state to another.

Analyses by X-ray diffraction do not always distinguish the components of a binary system because first, a single value of the long spacing may be interpreted as being caused either by a single constituent or by an average of values for two or more distinct forms (two or more separate phases of the same soap or of different soaps); and, second, the short spacing values for two individual soaps or soap phases are unique, but when they are present together the peaks may overlap and their resolution becomes difficult and sometimes questionable. On the other hand, observations by electron microscopy are in excellent agreement with chemical analyses, and in such cases prove to be more rapid and accurate than X-ray diffraction techniques.

As a third phase of this investigation, the physico-chemical properties of solutions of commercial soaps and detergent materials were examined in co-operation with W. W. Walton and J. I. Hoffman for the purpose of interrelating the colloid-chemical nature of the solutions to the phase nature of the solids.

Hence, data were obtained on the electrical conductivity, surface tension, *p*H, opacity, and rate of growth of foam, of aqueous solutions of numerous soaps and detergent materials. Some qualitative observations were also made on the physical behaviour of the soaps.

Molecular Arrangement

In most cases, there is no great difference in the value of any of the physico-chemical properties for products in any given type of soap as, for example, toilet, coco, or glycerin. X-ray diffraction data and observations by electron microscopy indicate that the molecular arrangements and surface features (phase nature) of these products are very similar.

A correlation between the two thus seems reasonable but has not been attempted quantitatively in the present investigation, mainly for lack of specific details regarding the composition of the products and the various mechanical, thermal, and other treatments received during the manufacturing process.

On plotting the values for each property against the soap content in various solutions, discontinuities are obtained in otherwise smooth and regular curves. The discontinuities occur in two general regions, at approximately 0.1 to 0.2 per cent and 2 to 2.5 per cent of soap. That in the lower concentration is brought about by the formation of a single layer of the soap molecules on the surface, whereas that in the higher region indicates the formation of soap micelles (ionic micelles) with single or multiple charges.

The comparatively steady values of conductivity and surface tension obtained beyond this higher concentration indicate that both the surface and the interior of the system are saturated with respect to the charged micelles.

Constant Values

The synthetic detergents are characterised by their ready solubility in cold water. Solutions of these materials may be either acid or alkaline and have an almost constant value of conductivity and surface tension at high concentrations, and extremely low and constant values of opacity at lower concentrations.

On the basis of colloid-chemical concepts, an efficient cleansing compound should have a low surface tension, a relatively high electrical charge, and ability to form colloidal micelles at low concentration. This facilitates solubilisation.

When the physico-chemical data for solutions of soaps and synthetic detergent materials are considered together, it is seen that greater surface activity and an optimum degree of micelle formation, both in number and in size, are obtained with dilute solutions of synthetic detergents and concentrated solutions of the soaps.

Consequently, cleansing should be achieved better and more economically by using soap solutions of relatively high concentrations and synthetic detergent solutions in the lower concentration region.

SCIENCE LIAISON

Activity of the British Council

SCIENCE received an important share of the attention of the British Council during 1948/49.

Some evidence of this was afforded by the newly issued annual report, which indicates that the science group of departments was re-organised, the engineering and technical side of the science services department being taken over by a combined sciences department. The latter becomes the section for all sciences other than agriculture and medicine.

Widespread reliance on British achievement was reflected in the increasing requests made to the overseas science officers. The Davy-Faraday exhibition, for which the council was the British organising body, in Paris in May, was visited by over 100,000 people.

In some countries the council subsidised lecturers whose work accustomed their pupils to the use of British equipment. As a result of a series of I.C.I. films on anaesthesia developments in Britain being shown in Italy, three schools on anaesthesia have been established, based on British practice and using British equipment.

A number of fundamental surveys were made, of scientific achievement in British universities and equivalent institutions and of the financial resources to permit the interchange of British and foreign scientists, promoted by Unesco.

Laboratory Equipment Needed

In a preface to a pamphlet, "Science Laboratories in Need" (HMSO, 9d.), an appeal is made by Dr. Jaime Torres Bodet, director-general of UNESCO, for funds and materials to replace the vast losses through destruction or looting during the war of technical equipment in educational centres in Europe and Asia.

TABLE 2.—PHYSICO-CHEMICAL PROPERTIES OF SOAP SOLUTIONS

Type	Major constituents	Phase	Concentration = 2.5 per cent soap: Electrical conductance ohms/c.c. $\times 10^{-6}$	Surface tension dynes/cm.	pH	Opacity Klett scale divisions	Rate of growth of foam. Time in seconds per 100 divided rise
Toilet	Sodium palmitate Sodium oleate	Beta Omega	27.24	32.00	10.04	300	19
Medicated	Sodium palmitate Sodium oleate	Beta Omega	27.39	32.90	10.07	200	23
Glycerin	Indefinite		31.06	34.35	10.00	190	19
Coco	Sodium laurate Sodium myristate	Omega Omega	27.30	28.45	9.17	2	19
Laundry (washing) ...	Indefinite		43.48	33.04	10.16	46	20
Shaving	Sodium palmitate	2 or more	28.12	34.20	10.04	660	30

The Manufacture of Plate and Sheet Glass

Some Recent Technological Advances

SOME of the progress made during recent years in the methods of manufacture of plate and sheet glass was revealed in a paper by Dr. H. Moore, professor of glass technology, University of Sheffield, which he read before a meeting of the Royal Society of Arts, in London, recently, at which Mr. L. H. A. Pilkington, of Pilkington Bros., Ltd., presided.

Developments in plate-glass manufacture during the past 25 years had resulted from three major changes in methods of production, said Dr. Moore. The first step necessary, if any continuous process were to be developed, was to replace the older pot-melting process by another in which the glass would be melted continuously and fed to some machine in which it could be rolled out as a continuous ribbon.

To achieve this, "tank-melting" was adopted. In tank-melting the raw materials were introduced at one end and, as they passed forward, were exposed to flames which raised the temperature to 1500°C. or upwards to 1540°C., so that the raw materials were melted to form glass.

Machinery Advance

While this method of producing the rolled glass was in process of development, a machine was being devised to enable the glass to be ground and polished as a continuous operation. The development of this machine—the continuous grinder and polisher—represented an immense advance in production, associated with a marked improvement in the quality of the finished product. It would not have been unreasonable, therefore, to expect no further developments of importance for some considerable time. In the event, however, the machine was scarcely in operation before preliminary designs were being worked out for one of a still more revolutionary character, namely, the twin grinder and polisher.

In this machine it was proposed to pass the ribbon of glass direct from the annealing lehr to a grinding machine which would operate simultaneously on both surfaces, then to pass it forward to a polishing machine, still as a continuous ribbon, to be polished simultaneously on both sides. This bold conception was, in fact, worked out and the first machine constructed in little more than ten years from the completion of the first continuous grinder and polisher.

There were many difficulties to be overcome. One prime essential was to ensure that the ribbon should not deviate from straightness by more than three or four inches over the whole of its quarter-mile length, which demanded very accurate control of temperature across the annealing lehr in the first place, and precise balancing of the forces exerted by the grinding and polishing heads after the ribbon had entered the machine itself.

It was also necessary to provide means whereby the sand delivered to the grinding runners underneath the ribbon should be distributed evenly across the whole of the under-surface, so as to ensure that the rate of grinding should be the same at all points.

These and many other difficulties connected with the grinding process were rapidly overcome, and at the outbreak of the second world war most of the problems associated with the polishing process had also been solved. The war interrupted the investigation of the remaining problems, but already some hundreds of miles of glass had been produced on the machine, satisfactory in every respect.

Breakages due to minor faults had, however, kept production below the rate for which the machine was designed; and the need for maximum production during the post-war period had further delayed the final perfecting of the twin-polishing process. It was, however, merely a matter of awaiting the time when the necessary equipment could be installed and sufficient staff allocated to the final investigation of the comparatively minor outstanding problems.

Ceramics in Scotland

An expanded market for ceramic chemicals and pigments is anticipated in Scotland as several new ventures in this field develop. Plans are being prepared for an expansion of the industry at Morar, where a successful craft pottery has been launched, also at Kirkcudbright. In addition, the North of Scotland Hydro Electric Board is considering the possibility of assisting in the development of potteries throughout the Highlands as one method of encouraging the use of electricity.

NORWEGIAN PLASTICS & BASIC CHEMICALS

Widespread Expansion of Capacity Since the War

THE belief that there is no basis for the development of a chemical industry in Norway because of the lack of many essential materials such as coal, salt and potash, was disputed with conviction by Mr. Einer Slatto, director in the Norwegian Ministry of Industry, when he addressed a meeting of chemical engineers at Trondheim. Mention was made of the plans for expansion and development under OEEC of the plastics industry.

There was in the Spitzbergen deposits, he said, enough coal to supply the needs of the Norwegian chemical industries for a long time, and sulphuric acid could be made available in adequate quantities and at a reasonable price.

From 500,000 tons of coal, and with a power supply of 100,000-120,000 kW, it should be possible to produce 100,000 tons of petrol, 15,000 tons of methanol (from which formaldehyde can be obtained), 50,000 tons of coal-tar and 250,000 tons of coke. The tar obtained from coking Spitzbergen coal was rich in phenols, and might be suitable for production of materials such as Bakelite.

The Norwegian carbide industry had a capacity of 100,000 tons, but had not come near full utilisation owing to shortage of power. A substantial part of the carbide produced (about 32,000 tons) was used for production of calcium cyanide, the present output of which was 40,000 tons, corresponding to 8000 tons of nitrogen. Present plans envisaged the doubling of this production to 80,000 tons, 18,000 tons of which would be further processed to dicyanodiamide.

Synthetic Resins

Dicyanodiamide would provide a source of melamine, from which excellent thermosetting moulding compounds and synthetic resins were obtained. Difficulty of securing patent rights was, however, likely to be a serious obstacle.

Norway, before the war, imported a substantial part of her requirements of caustic soda and chlorine from Germany. Supply difficulties since the war and the greatly increased demand, particularly for caustic soda, made it necessary to build two new plants for electrolytic production of chlorine. These plants would have an aggregate capacity of 15,000 tons, 50 per cent lye and an equal quantity of chlorine. The present production was 4500 tons. Part of the chlorine produced would go to the woodpulp industry, with a surplus for production of trichloroethylene and polyvinyl chloride.

Phenolic moulding has been in progress in Norway since 1930, states the Norwegian Export Council, and when war broke out there were seven firms engaged in such production. A considerable import trade developed, particularly for moulding materials. Since the war the operating firms had been increased to 12, employing 81 presses capable of providing annually about 500 tons of thermosetting plastics fabrications.

Thermoplastics

There has, in recent years, been a growing interest in injection moulding, with a consequent tendency on the part of firms working with thermosetting plastics to extend their production programmes to thermoplastics.

Import licences for raw materials have, however, been even more difficult to obtain than for thermosetting materials, but some machines have been imported and others built in Norway.

About 60 Norwegian firms are at present working with thermosetting and thermoplastic materials and a substantial number of them are engaged in both types of production. Present capacity, it is thought, should prove sufficient for some time.

Welding has recently been practised with materials such as polyethylene and the harder kinds of polyvinyl chloride. The most popular substances are acrylic materials, particularly of the transparent type.

A factory producing phenolic laminates has a capacity of 500 tons, which should meet the greater part of the domestic demand for electrical insulating boards. The extrusion of tubes, rods and ribbons has been undertaken by three firms, two of which built their own machines.

Shortage of raw materials has been the chief limiting factor in the development of the Norwegian plastics industry. Imports of plastic materials in 1948 had a value of nearly Kr.5 million, of which a little less than half consisted of thermosetting materials, the remainder being made up of thermoplastic powders, sheets, etc. Returns received from 59 out of the

73 existing factories disclose the following imports of raw materials:—

	1948 Consumption	1949 Imports (Planned)	1950 Imports (Planned)
	Tons		
Phenolic materials ...	210	352	540
Urea ,, ...	88	285	475
Melamine ,, ...	4	60	120
Polystyrene ...	137	308	425
Cellulose acetate ...	53	254	329
Polyethylene ...	2	46	123
Nylon	1	5	17
Methacrylate plates	19	114	149
Casein moulding materials	1	9	12
Polyvinyl chloride	61	507	768
Other vinyl moulding materials ...	3	20	39
Other elastomers ...	9	132	265

In view of the present foreign exchange position, the prospect of reaching the 1949 and 1950 targets is, of course, uncertain.

An Elastic Programme

The first of the more ambitious Norwegian projects for production of plastic materials began to take shape in 1946 with the formation of A/S Norske Kunstharpikser. This company, which will produce resins for moulding powders, lacquers and adhesives, is to start operations next year. Its programme is fairly elastic, permitting production to be shifted from one product to another in accordance with the market situation and the supply of raw materials, such as urea and phenol.

During the current year, two firms have started production of phenolic moulding materials using imported resins. One of the firms will base its production on resins supplied by A/S Norske Kunstharpikser as soon as the latter company gets started. These companies—A/S Lilleström Fabrikker and A/S Resin—will have a combined production capacity in excess of present Norwegian requirements.

Norway should be favourably placed for production of cellulose acetate, which A/S Borregaard plans to supply.

Casein plastics offer, *inter alia*, advantages of mechanical strength, easy adaptation to machining, and light and pure colours. A recently established Norwegian firm, A/S Norsk Kunsthorn, of Levanger, makes exclusive use of first-class casein in the manufacture of galalith products. This new factory has powerful financial backing and will produce galalith in the form of plates, rods, tubes, etc. Special colours, or combinations of colours, can be made to order. An exportable surplus from the factory's production should be available from 1950.

Polyvinyl chloride will be produced by A/S Heröya Elektrokjemiske Fabrikker, which is now building a plant expected to reach the production stage in mid-1950. Further enterprises include a plant to be operated next year by A/S Norsk Hydro for the production of urea crystals in sufficient quantity to meet the Scandinavian demand and leave an exportable surplus.

For the further processing of urea into synthetic resins a plant is under construction which will produce formaldehyde with the aid of machinery received from Germany as compensation. The methanol required for this will be imported for the time being.

Although plastics production in Norway is hindered by a number of disadvantages, of which an important one is the lack of benzene, constant research is overcoming some of the major difficulties. Commercial development appears to keep abreast of this work, reports the Export Council.

CEYLON SHARK LIVER OIL

DEVELOPMENT of what may prove a valuable addition to established oil and fat sources, Ceylon's rapidly expanding shark liver oil industry, is indicated by recent successful research in that country.

Malted shark liver oil will soon be obtainable on the Ceylon home and export markets. To cope with the demand for oil of high vitamin content, Dr. S. N. Ganguly, superintendent of the Government factory, recently carried out a preliminary survey, and found that the coast between Jaffna and Trincomalee abounded in fish giving high yields of vitamin oil.

Investigations are now being conducted regarding the possibility of shark fishing by means of trawlers to ensure an adequate and regular supply of raw material for the increasing demands of the factory.

Among the species found locally, one type of oil has a vitamin content of over 80,000 units per gram. Simultaneous laboratory investigations have been carried out for the concentration of low potency oils into high potency oils. It has been possible to produce an oil with a vitamin content of 126,000 units, and the economic possibilities of this process are being further studied.

Samples of high potency oils produced in Ceylon have been sent to concerns in the U.S.A. and the United Kingdom for corroborative tests.

At present the Department of Industries has its own shark liver collecting centres on the coasts of Ceylon.

The Chemist's Bookshelf

INDUSTRIAL HYGIENE AND TOXICOLOGY. Edited by Frank A. Patty. 1949. New York and London: Interscience Publishers. Vol. 2. Pp. xxviii, 535-1138. 90s.

The first volume of this work, prepared by a group of specialists under the editorship of Frank A. Patty, director of the Industrial Hygiene Service, General Motors Corporation, Detroit, was reviewed in THE CHEMICAL AGE in March (*60*, 428). This concluding volume is of equally high standard and as authoritative, and goes minutely into the properties and physiological action of various contaminants of the atmosphere which are likely to be met with in industrial situations. It discusses also permissible concentration, inflammability, odour, and other warning properties. The different classes of contaminants considered, covering a very wide range of over 300 individual chemicals, are grouped conveniently in separate chapters, *i.e.*, under the headings of halogens; alkaline materials, arsenic, phosphorus, etc.; compounds of oxygen, nitrogen and carbon; cyanides; lead; metals other than lead; aliphatic hydrocarbons; aromatic and cyclic hydrocarbons; halogenated hydrocarbons; alcohols, organic acids; esters; aldehydes; ketones; ethers, glycols, etc.; nitro and amino compounds; and phenol and phenolic compounds. All these chapters include numerous tables giving data on physiological response to various concentrations of the chemicals concerned.

The last chapter, however, is by far the most interesting, being devoted to the recognition and control of industrial exposures. It gives significant information about various processes, occupations, and industries which have particular need to safeguard the health of their workers. Here, arranged alphabetically, such subjects are dealt with as abrasive blasting, and acetylene manufacture, meat packing, milling and baking, and less common industrial tasks, as quartz crystal cutting and radium dial painting, stone quarrying and crushing. In this chapter the industrialist, the consultant and the works manager may find valuable reminders—if not, perhaps, entirely new knowledge—for maintaining a greater measure of hygienic safety. For instance, under the heading of "Aniline manufacture, distillation, and handling," we learn that even the small amount of aniline used in some formulæ for waterproof ink has been responsible for poisoning due to skin contact with unlaundered cloth which is stamped with such ink. Aniline, likewise, is also dangerous on shoe soles. These are typical of a number of such pointers to obscure forms of poisoning on which information is not commonly available.—C.H.B.

PAINTS. Selected Government Research Reports (Vol. 2). Ministry of Supply and Technical Information and Documents Unit, Board of Trade. 1949. (HMSO). Pp. 70. 5s. net.

Magnesium alloys are the subject of three out of the eight reports contained in this volume. No. 5 covers a series of seawater spray corrosion tests made on painted chromate treated magnesium alloys, during which it was found that a series of primers based on vinyl acetate, vinyl chloride, cellosolve methacrylate and butyl methacrylate pigmented with china clay and zinc chrome, while affording excellent protection, were not suitable for general use without modification, as the dry films were soft and wrinkled. In No. 7 the effects of heating on the corrosion resistance of chromate treated and painted magnesium and alloy castings were observed and No. 8 describes tests using the addition of 1/2000 part of phenyl mercury acetate as a fungicide in coat paints.

Other reports covered: the Extraction and Uses of Blood Albumen (No. 1); Viscosity of Paints and Suspensions (No. 2); Temperature Sensitive Paints (No. 3); The Effect of Surface Treatment of Brass and Yellow Metals on the Adhesion of Paint Films, with special reference to the Painting of Optical Equipment (No. 4); and Ground Flax Shives as a substitute for Pigment Dyestuffs (No. 6).

The volume is the first of a series of reports based on scientific and technical research during the war. A wide field will eventually be covered, each volume containing a number of individual reports on one particular subject (THE CHEMICAL AGE, *61*, 734).

Technical Publications

INORGANIC salts, if not removed, may seriously interfere with subsequent chromatographic analysis. After desalting, however, perfect chromatograms can be obtained. An electrolytic desalter forming a compact unit has been designed by the Shandon Scientific Co., London. It can deal with volumes of solutions of the order 1-10 ml., and is especially suitable for use with blood ultra-filtrates or non-protein fractions of tissue fluids. The apparatus can be used to desalt a wide variety of solutions. The ammonium ion, however, if present in considerable concentration, should be first removed by the obvious methods, as the ammonium amalgam formed during the desalting process tends to clog the mercury.

* * *

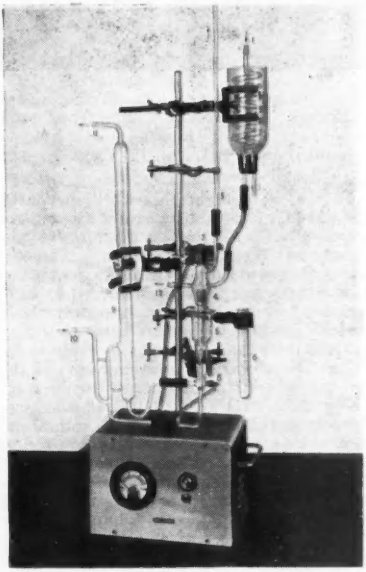
COMBUSTIBLE dusts constitute a special fire hazard in industry, the presence of loose fine material tending to increase the rate of spread of fire in a building, while dust suspensions in the atmosphere may have explosive properties. A survey of "Fires Involving Dusts" has been made by D. J. Rasbash and is now available from the Fire Protection Association as Technical Booklet No. 5. Ninety-one civil fire reports were examined and the more important precautions which should be observed are summarised and indications are given of the problems which still require investigation.

* * *

FISH oils after pressing, "dry-rendering," or solvent extraction, are increasingly used to-day in the manufacture of a variety of products ranging from margarine and cooking fats, sulphated oils for leather tanning, paint and varnish oils and synthetic resins to beauty preparations. In "The Engineering and Complete Fish and Whale Oil Plants" (Bulletin 036) now available from Bamag, Ltd., London, the various processes of extraction, clarification, refining, hydrogenation, etc., are described and illustrated with photographs of plants and flow diagrams. The technology of whale oils, including sperm oil, is also covered.

* * *

THE importance of expert technical assistance on the spot in making a successful entry into new markets overseas under competitive conditions is urged in the latest brochure issued by The Osborne-Peacock Co., Ltd., London. Marketing systems are reviewed.



[Courtesy of the Shandon Scientific Company].

Electrolytic desalter for removal of inorganic salts

GLASS-ENAMELLED steel installations adaptable to all the usual methods of processing chemicals have long proved their value where contact of the chemical product with metals must be avoided. Glass protected reaction vessels, condensers, stuffing boxes and agitators, pipes and fittings that can be assembled into complete glass enamelled installations are described with diagrams and photographs in the latest Pfaudler catalogue (CH.32) and leaflets (IN.31 and PF.28 Rev.) now available from Enamelled Metal Products Corporation (1933), Ltd., London.

* * *

THE Year Book of the Textile Institute, the second issue of which (for 1949-50) is now available, again provides a comprehensive guide to the facilities available to students of textile technology and to the wide range of activities of the Institute. The present issue runs to 258 pages and will be of value to all textile technologists and students. (*continued overleaf*).

DETAILS of specification, physical constants, general solvent applications and chemical applications, etc., of Shell chemical solvents have been published by Shell Chemicals, Ltd., London, as a series of technical information sheets, bound in convenient loose-leaf form. The present series includes:—Isopropyl ether (218); methyl isobutyl ketone (219); secondary butyl alcohol (220); methyl ethyl ketone (221); diacetone alcohol (222); acetone (223); tertiary butyl alcohol (224); isopropyl alcohol (225); mesityl oxide (228); and methyl isobutyl carbinol (259).

* * *

DIE Deutsche Akademie der Wissenschaften zu Berlin (German Academy of Sciences), Akademie Verlag, Berlin, N.W.7, publishes in small booklets, now appearing in occasional numbers, a series of lectures and dissertations of which the latest include "Floating of DDT in the Nerves of Insects," by Wolfgang Heubner, who established that DDT more intimately affects the nerves than the tissue fluids. "Shaping of the Organisms—a Chemical Problem," by Kurt Noack, describes experimental data showing how certain chemical compounds influence the shaping and organ-formation of plants and animals. "Effective Quantum and Description of Nature," by F. Hund, deals in detail and from some new points of view with Planck's quantum theory.

ION exchange as a means of softening water is the subject of one of the main articles in the "Rohm and Haas Reporter" (Vol. 7, No. 3). Another feature illustrates how Lykopon, the first sodium hydrosulphite manufactured in the U.S.A., and originally used in textile processing and other industrial operations, is now being used as a raw material for the making of pharmaceuticals.

* * *

A NEW technique in painting by application of fluorescent pigments as an artistic medium is described in an article by J. L. H. Jonker and S. Gradstein in "Philips Technical Review" (Vol. II, No. 1). Other articles describe the development of resistance strain gauges and their wide application to engineering problems, and an apparatus for detecting fine cracks on the surface of the wires passing through the bases of electronic valves.

* * *

UNDER the title "£100 per lb.," the Uddeholm Company, Uddeholm, Sweden, has recently issued a small folder, describing its AEB high-carbon stainless steel strip. It is used by scale makers, the dimensions being 3/32 in. by 0.0022 in. Only the very fine material and fine workmanship can achieve such a size—and the price bears this out. The makers believe it to be the most costly form of steel in commercial use.

FILM TRAINING UNDERGROUND

THE appearance of documentary and training films in unexpected places is becoming increasingly common, but this appears to be the first recorded instance of the educational film going underground. This visit to the underworld, 800 ft. down in the Imperial Chemical Industries' anhydrite mine at Billingham, was to show miners the graphic review of safety measures compiled by the Billingham works film unit

PERSONAL

THE University of Birmingham has announced the following appointments. Lectureships: DR. J. H. TURNBULL, chemistry; DR. W. S. NORMAN, chemical engineering; F. R. N. NABARRO, metallurgy; DR. G. F. J. GARLICK, physics. Research fellows: K. B. MATHER to be I.C.I. research fellow in physics; DR. D. W. WAKEMAN to be I.C.I. research fellow in metallurgy.

Presenting the Colwyn Gold Medal for 1949 to MR. E. A. MURPHY, manager of Fort Dunlop general developments division (THE CHEMICAL AGE, *61*, 683) MR. HERBERT ROGERS, the new president of the Institution of the Rubber Industry, described him as the principal "back-room-boy" in the latex field, associated with the Dunlop Company in a series of over 100 latex patents. It was, he said, due to the research of Mr. Murphy and his colleagues that latex was to-day available in bulk supplies and the raw material of a very important section of the rubber industry.

DR. N. HOWELL FURMAN, Russell Wellman Moore Professor of Chemistry in Princeton University, who during the war developed new analytical techniques for America's atomic bomb project, has been chosen president-elect of the American Chemical Society. He will serve in 1951. President for 1950 will be Dr. Ernest H. Volwiler, vice-president of Abbott Laboratories, North Chicago.

As a tribute to his work on behalf of the London Section of the Oil and Colour Chemists' Association over many years, an engraved silver cigarette case was presented to MR. DAVID E. ROE at a recent ladies' night of the section.

MR. T. J. SALES has been appointed marketing director of the North-Western Divisional Coal Board, with effect from January 1, 1950, in succession to Col. G. G. H. Bolton, who was recently appointed deputy chairman.

MR. ROBERT BUCHANAN, scientific instrument maker, 75 Robertson Street, Glasgow, left £33,364.

£2200 for Cortisone Research

A grant of £2200, spread over two years, has been made by the Nuffield Foundation to the Royal Technical College, Glasgow, to enable Prof. F. S. Spring, of the Department of Chemistry, to undertake research into cortisone and related compounds. There are several similar grants elsewhere.

NEXT WEEK'S EVENTS

MONDAY, DECEMBER 19.

Institution of Works Managers

Glasgow: 39 Elmbank Crescent, 7 p.m. W. McCorkindale: "Industrial Salvage and Recovery."

Sheffield: Royal Victoria Station Hotel, 7 p.m. L. C. Ord: "Industrial Efficiency."

Electrodepositors' Technical Society

London: Northampton Polytechnic, St. John Street, Clerkenwell, E.C.1. Discussion: "Throwing Power"; speakers: G. E. Gardam, J. W. Cuthbertson and S. Wernick.

TUESDAY, DECEMBER 20.

Incorporated Plant Engineers

Glasgow: Engineering Centre, 351 Sauchiehall Street, 7 p.m. J. Barrington Stiles: "Metallising for Industrial Plant Maintenance."

Hull Chemical and Engineering Society

Hull: Church Institute, Albion Street, 7.30 p.m. G. H. Pulfrey: "Progress in Everyman's Transport."

Obituary

The death has occurred at his home, in Balloch, Dumbartonshire, of MR. ALEXANDER ROSS ANDERSON, engineer and manager of the Vale of Leven area gas undertaking for 12 years. He was 53 years of age and went to the Vale of Leven from Glasgow Corporation 20 years ago as a chemist.

The death occurred suddenly, on December 6 at his home, Brookdale, Dobcross, near Oldham, Lancashire, of MR. T. P. WARD, managing director of Morton, Son & Ward, Ltd., chemical and general engineers.

The death was reported recently of MR. PETER IRVINE, aged 73, a former Glasgow pharmacist, whose wife, Mrs. Jean Kennedy Irvine, was the first woman president of the Pharmaceutical Society.

PROF. HUBERT KAPPEN, the international authority on agricultural chemistry, has been killed in a motor-car accident while returning home after delivering a lecture at Bonn University. He was 71.

Birmingham Factory Explosion

The cause of an explosion last week at a Birmingham works making aluminium hollow-ware was being investigated by the explosives department of the Birmingham City Police. Widespread damage was caused.

HOME

Christmas Telephone Services

All telephone services to Europe will, the Post Office advises, be open as usual over the Christmas and New Year periods.

Casein Control Ended

The Board of Trade has announced that licences to acquire and dispose of acid or lactic casein will not be required after January 2. (THE CHEMICAL AGE, *61*, 778.)

Shale Oil Centenary

Scottish Oils, Ltd., is to commemorate the 100th anniversary of the Scottish shale oil industry in 1950 with a three-day conference for technicians and experts from the various shale mining and processing countries. Scotland's, is the oldest continuously-operated shale oil industry in the world.

Coal Output

Britain's deep-mined coal production last week brought the year's aggregate output so far to within 10½ million tons of the lowest target figure (202 million tons), with only three weeks to go. Comparative figures are:—Last week: Total 4,598,300 tons (deep-mined 4,378,700 tons, opencast 219,600 tons). Previous week: 4,575,500 tons (deep-mined 4,358,400 tons, opencast 217,100 tons).

Factory Accidents

The possibility that industrial accident prevention work may be neglected in the interest of accelerating output was mentioned by Mr. L. E. Cornford, technical department of I.C.I., Ltd., in his paper on "The Technique of Safety Education," at Scotland's first Industrial Safety Conference in Edinburgh last week. "I think there is this danger," said Mr. Cornford, "because, unfortunately, safety is still considered by many people to be an ancillary service."

More Dollar Exports

An increase of £4.4 million over the October figure in the value of U.K. exports in November is recorded by the provisional figures quoted last week by the Secretary for Overseas Trade. The average monthly value of exports to the U.S.A. in 1948 was $22.2 million, whereas in November 1949, at the considerably lower sterling conversion rate, exports were worth $20.5 million. Exports to all countries in November produced a provisional total of £160.4 million, with a daily rate 9 per cent above that of November last year.

Export Orders

Chamberlain Industries, Ltd., give news of seven recent export orders for cranes and metal working machines of a total value of over £17,000.

Glucose Manufacturers De-licensed

By an amending Order which came into force on December 11, and from that date, manufacturers and wholesalers of glucose will no longer be required to hold a licence.

Workers' Amenities

At the Widnes branch of W. J. Bush & Co., Ltd., chemical manufacturers, three newly completed departments were opened last week. These comprised stores, fire station, and changing rooms, the latter being equipped with clothing lockers and shower baths for the use of the process workers.

Good Demand for Boiler Plant

A high level of demand for boiler plant, at home and in new markets of which Venezuela, Brazil and Peru are noteworthy, is reported by Cochran & Company, Annan, Ltd. The company is reorganising its works, extending the heavy boiler shop and improving the pattern and works maintenance shop.

Record Production of Sodium Cyanide

Workers at the I.C.I. General Chemical Division's Cassel Works, Billingham, who have produced record quantities of sodium cyanide for four successive weeks, were last week entertained by the management to a smoking concert. Congratulating them on their achievement, Mr. W. C. Lyle, works manager, said their production record was helping to increase British earnings from hard currency areas. The Cassel Works is regarded as being the largest European producer of sodium cyanide, which is exported extensively to the gold mining areas of South Africa.

Petrol Indicator Problem Revived

Investigations carried out by fuel officers of petrol in a private pump at Broughton, near Preston, filling station, have revived the problem of analysis results confronting the Ministry of Fuel. The petrol was in fact "white," but reacted to a "red" test due to a stabilising chemical which had been added before it reached England. An analysis was carried out by the Lancashire County Analyst's department and Dr. J. B. Firth of the Home Office Forensic Science Laboratory, Preston, and the findings are being studied.

OVERSEAS

Japan Producing Urea

Production of urea has been started in Sunagawa, Japan, and is yielding about 1000 tons per month.

Methane-Electric Railway Project

The Italian Committee of Reconstruction is studying a scheme to employ methane-driven electric generators in the Valley of the Po to supply some of the power for Italian State Railways. If the research in Lucania brings good results, the scheme will be extended to Southern Italy.

Atomic Research in S. Africa

South Africa may be visited by a party of atomic scientists who will leave the U.S.A. next year to conduct atomic research in agriculture in Africa. This information was given by a Durban research worker who has been asked to make arrangements for the care and shipment of equipment after its arrival in Durban from America, states *Reuter*.

Irish Peppermint

The first two ounces of peppermint oil to be commercially produced in Ireland have been sent to England for analysis. The herbs came from an experimental farm in Leixlip and the oil was distilled in a Government research laboratory. A commercial distillation plant may be built and it is hoped to put two acres of land into peppermint production next year. The yield per acre is 20-30 lb. and the present price for oil from England is from 3s.-5s. per dram.

Plastics in the Argentine

The Argentine Government announced recently that factories processing plastic products, including resins, gums, powders, etc., were considered as of national utility, and that machinery, equipment and essential raw materials required for these industries, and which could not be supplied locally, would therefore be exempt from customs duties. At the same time, the importation of plastic products into Argentina would require special sanction by the Ministry of Industry and Commerce, according to the needs of the market and the output of local industry.

Penicillin Production at Höchst

Reports from Western Germany indicate that large-scale production of penicillin is expected to begin in January next in the Höchst works of the former I.G. Farbenindustrie.

Oxygen for Jugoslavia

A new oxygen plant is to start production soon near Sarajevo, Bosnia, Jugoslavia. It will supply the whole of the Provinces of Bosnia and Herzegovina with compressed oxygen.

Venezuelan Petroleum

Petroleum production in Venezuela has reached an average of 1.4 million barrels per day. Although crude prices are maintained, those of petroleum fell from U.S.$2.50 in 1948 to U.S.$1.15 per barrel in June this year.

Brazilian Chromite

After a considerable decline during the war, Brazil is again exporting chromite, deposits of which exist in the States of Bahia, Minas Gerais, and Goias, those in the first-named being estimated at 140,000 tons.

Italian Refractories

Italy's capacity to produce a vast range of refractory materials, including alumina and silica types, is recognised in a current programme, which in the current year provided for a total output of 200,000 tons of such materials, of which about 76,000 tons are of silica type. It will be necessary to import from Germany about 10,000 tons of siliceous products to supplement local supplies.

U.S. Potash Consumption

Total deliveries of potash salts by U.S. producers during the first nine months of 1949 amounted to 1,663,262 tons, containing 894,982 tons K_2O. Potash for agricultural use in the United States, Canada, Cuba, Puerto Rico, and Hawaii totalled 837,816 tons K_2O contained in 1,570,560 tons of salts. Of this, the chemical industry took 78,613 tons of muriate of potash and sulphate of potash, containing an equivalent of 48,630 tons K_2O.

Law and Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Satisfactions

GOODALLS (DISINFECTANTS), LTD., Birtley. (M.S., 17/12/49.) Satisfaction November 14, of mortgage registered May 26, 1939.

WIRRAL REFINING CO., LTD., Birmingham. (M.S., 17/12/49.) Satisfaction November 17, of series of debentures registered November 30, 1926.

Increases of Capital

The following increases in capital have been announced:—DIAMOND FERTILISER & CHEMICAL CO., LTD., from £25,000 to £100,000. NORDAC, LTD., from £10,000 to £75,000.

Company News

Mufulira Copper Mines

Production of blister copper by Mufulira Copper Mines in July-September totalled 17,833 long tons. Sales revenue was £2,031,500. The operating expenditure amounted to £900,500, leaving a gross operating surplus of £1,131,000. After allowing for other expenditure and provision for replacements the estimated net profit, before taxation, was £954,500.

Change of Name

The title of Tubes & Fittings (Wholesale), Ltd., producers of special tubular and pipework installations, has been changed to Tubes & Fittings (Bristol), Ltd.

New Registrations

Airkem, Ltd.

Private company. (475,779.) Capital £1500. Manufacturers of chemical preparations of all kinds for reducing odours and for the conditioning and re-conditioning of air, etc. Reg. office: Bilbao House, 36 New Broad Street, E.C.2.

Kamaco, Ltd.

Private company. (475,501) Capital £1000. Manufacturers, etc., of chemical and commercial substances. Directors: M. J. Cockle and H. Kaminski. Reg. office: 122 Clarendon Road, W.11.

F. Duckworth & Co. (Blackburn), Ltd.

Private company. (475,476). Capital £5000. Manufacturing chemists. Directors: F. Duckworth, F. H. Duckworth. Reg. office: 24 Park Road, Blackburn.

Chesterfield Street Laboratories, Ltd.

Private company. (475,750.) Capital £100. Manufacturers of chemical preparations. Solicitors: R. J. Apthorpe-Webb, 19/20 Bolton Street, W.

M.V.A. Laboratories, Ltd.

Private company. (475,713). Capital £5000. Objects: To acquire the business of manufacturers of sulphur products carried on by J. Mitchell-Lewis and E. G. Molyneux, at M.V.A. Laboratories, Lymington Road, Highcliffe, Hants. Directors: J. Mitchell-Lewis, E. E. Young. Solicitors: Mitchell & Ellis, 129 Poole Road, Westbourne, Bournemouth.

Vincent Patents, Ltd.

Private company. (475,392). Capital £2000. Research, experimental, development, designing and chemical engineers, technical consultants, etc. Reg. offices: 6 Wine Office Court, Fleet Street, E.C.4.

Joint Consultation

"THERE is an overwhelming case for the establishment of machinery which provides for full consultation between management and workers, but it is a fallacy to suppose that the workers themselves can participate in actual management. The only effect of such a policy is to turn their accredited representatives in the trade unions into their masters, which leaves the workers without proper representation and fundamentally undermines the position of the trade union leader, who in all these matters has a most vital and responsible part to play." Mr. G. W. Odey, M.P., a member of the Executive Council of the National Union of Manufacturers, at a "Free Enterprise" meeting arranged by the National Union in Manchester last week.

Uraniferous Minerals in Brazil

Reports from Brazil state that an extensive deposit of uranium bearing mineral has recently been discovered at San Jose de Rei, near the British gold mines in Minas Geraes. The deposit is said to extend over six miles, with a thickness varying from 260 to 400 ft.

The Stock and Chemical Markets

STOCK markets have been cheered by the Australian election results, and good rises were scored, notably by Australian bank shares, which showed gains of up to £1. After initial small gains, British Funds, however, became uncertain, and this influenced the industrial and kindred sections, movements on balance having been small and unimportant.

After changing hands up to 43s., Imperial Chemical have eased to 42s. 6d. at the time of writing. Monsanto remained firm at 50s., Boake Roberts were 25s., Albright & Wilson 29s. 9d., and Brotherton at 19s. 3d. Bowman's 4s. shares eased to 5s. 9d. on the lower dividend. Elsewhere, F. W. Berk 2s. 6d. shares were 13s., Pest Control 5s. shares 8s. 6d. and Amber Chemical 2s. shares 4s. 6d. British Chemicals & Biologicals 4½ per cent preference changed hands around 18s. 6d., Fisons were 27s. 6d., and Laporte Chemicals 5s. ordinary at 9s. 7½d.

Lever & Unilever remained more active around 44s. and Lever N.V. were 44s. 1½d. Borax Consolidated deferred were again firm at 57s. 9d. and Glaxo Laboratories have been up to £22. Triplex Glass held their improvement to 18s., United Molasses showed activity at slightly over 39s. and British Glues & Chemicals 4s. ordinary became firmer at 18s. 9d. Dunlop Rubber at 61s. 9d. failed to hold best levels and shares of companies connected with plastics remained uncertain with British Xylonite at 60s., British Industrial Plastics 2s. shares 4s. 9d., De La Rue 23s. and Kleemann 8s. 6d.

Elsewhere, General Refractories firmed up to 22s. 9d. and Turner & Newall remained at 75s. On the other hand, British Aluminium (41s.) have so far failed to recover from their recent small reaction, and British Oxygen were 90s. 3d.

Associated Cement at 76s. 9d. showed maintained firmness on general confidence that prospects of the dividend rate being repeated for the current year are good, particularly in view of further growth in export business. Tunnel Cement at 45s. and Rugby Cement at 16s. 1½d. have been active at slightly higher levels and British Plaster Board 5s. ordinary were also higher at 13s. 6d.

Movements in iron and steels were moderate, although Dorman Long were good at 31s. 3d., United Steel strengthened to 28s., Guest Keen to 41s. 1½d. and Ruston & Hornsby to 27s. 6d. Courtaulds (34s.) and British Celanese (18s. 9d.) remained firm. Boots Drug at 50s. 3d. have moved in favour of holders. Griffiths Hughes were 21s. 4½d., Beechams deferred 14s. 9d. and Sangers 22s. 9d., while the 4s. units of the Distillers Co. fluctuated between 17s. 9d. and 18s. 3d.

Oils failed to hold earlier gains, being affected by Sir S. Cripps' request for economy. Shell, however, were slightly higher on balance at 68s. 1½d. and Anglo-Iranian were close to £7.

Market Reports

ACTIVE conditions continue in evidence in almost all sections of the industrial chemical markets, the price position being unchanged and firm. Delivery specifications against contracts have been well up to schedule and buyers for the chief consuming industries are becoming increasingly interested in contract replacements. On the export side inquiries continue to be fairly numerous and the aggregate volume of overseas trade in chemicals, dyestuffs and pharmaceuticals is being maintained at a high level. A steady trade is reported in the coal tar products and supplies generally are sufficient to meet immediate needs. The xylol position is an outstanding exception, the demand being greater than available supplies. Pitch continues in good request both for home and export.

MANCHESTER.—Traders on the Manchester chemical market during the past week have reported that quantities of the alkali products and other leading heavy chemicals have formed a steady supply against existing commitments, although, as is usual at this time of the year, there has not been quite the same pressure as regards new business. Exporters' inquiries have been fairly numerous. Except in one or two sections, trading conditions for fertiliser materials have been quiet. There has been a steady trade in most of the tar products, especially in the light distillates.

GLASGOW.—Turnover in the Scottish chemical market has been on a slightly increased scale, which may evidence a general feeling that many prices will increase in the New Year, particularly in view of the anticipated increase in rail rates. The supply position, however, has been well maintained and, apart from xylol, no particular shortages have been noted. The xylol position continues to be very difficult.

Patent Processes in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted will be obtainable, as soon as printing arrangements permit, from the Patents Office, Southampton Buildings, London, W.C.2, at 2s. each. Higher priced photostat copies are generally available.

Complete Specifications Accepted

Manufacture of steel.—Soc. d'Electrochimie, d'Electro-Metallurgie et des Acières Electriques d'Ugine. Nov. 17 1938. 631,235.

Process of making compositions and composite materials.—A. M. Monath. June 18 1945. 631,097.

Device for dispensing liquids.—Dole Valve Co.—Feb. 2 1945. 631,170.

Sludge tanks for reconditioning coolant liquid.—H. W. Hapman. April 23 1946. 630,963.

Process for obtaining by galvanic means a coating for protecting magnesium from corrosion.—H. M. Freud. July 26 1945. 631,287.

Method of making an artificial thermosetting resin and the resin resulting therefrom.—Quaker Oats Co. July 9 1945. 631,109.

Method for the preparation of nuclear substituted quinoline compounds and intermediates therefore.—H. R. Snyder, and R. E. Jones. June 4 1945. 631,110.

Preparation of compounds of the cyclopentanodimethyl - polyhydrophenanthrene series.—Merck & Co., Inc. July 14 1945. 631,238.

Gaseous fuel.—S. H. White. July 30 1946. 631,173.

Automatic flow regulating valves.—R. Shields. (Vickers, Inc.). Aug. 13 1946. 630,968.

Making of starch derivatives.—H. J. Fitzpatrick. (National Starch Products, Inc.). Aug. 29, 1946. 631.242.

Device for producing toxic vapours.—I.C.I., Ltd. Sept. 11 1945. 631,115.

Fumigating compositions.—I.C.I., Ltd., J. Taylor, J. M. Holm, and A. C. Hutchison. Sept. 18 1946. 631,114.

Coating compositions.—J. O. Farrer. (Continental Can Co., Inc.). Oct. 4 1946. 631,245.

Polymers and copolymers of fumaric acid diesters.—J. C. Arnold. (Standard Oil Development Co.). Nov. 5 1946. 631,117.

Recovery of salts from dilute solution.—Permutit Co., Ltd., and W. G. Prescott. Nov. 14 1946. 630,979.

Process for the manufacture of suspensions of phenols.—Pest Control, Ltd., and F. R. Eirich. Dec. 2 1946. 631,120.

Process of preparing oxazolone compounds. Merck & Co., Inc. Dec. 21 1945. 631,191.

Methine dye intermediates.—General Aniline & Film Corporation.—Dec. 29 1945. 631,124.

Process for the production of penicillin.—Merck & Co., Inc. Jan. 22 1946. 631,126.

Liquefied gas pumping systems.—W. A. Wildhack. Feb. 15 1946. 631,196.

Treatment of the surfaces of constructional and other materials.—Latik (London), Ltd., and A. E. Comisso. Feb. 13 1942. 630,990.

Utilisation of fuel gas containing low purity hydrogen in the catalytic refining of petroleum hydrocarbons.—C. Arnold. (Standard Oil Development Co.). Feb. 14 1947. 631,258.

Method of preparing linear polyesters.—Wingfoot Corporation. July 16 1946. 630,992.

Condensation products of ureides and formaldehyde.—Geigy Co., Ltd., H. Jones, and J. K. Aiken. Feb. 24 1947. 631,200.

Manufacture of thick foils of regenerated cellulose and cellulose derivatives.—Kooperativa Forbundet Forening U.P.A. May 10 1946. 631,260.

Manufacture of disazo-dyestuffs.—Ciba, Ltd. April 11 1946. 631,262.

Process for the production of organic carboxylic acid anhydrides.—E. I. Du Pont de Nemours & Co., W. F. Gresham, and R. E. Brooks. April 2 1947. 631,001.

Production of compounds of alginic acid and its derivatives.—Alginate Industries, Ltd., J. B. Speakman, N. H. Chamberlain, and C. M. C. Dorkin. April 2 1947. 631,002.

Pyrazole compounds.—E. I. Du Pont de Nemours & Co. May 3 1946. 631,269.

Stabilised synthetic polymers.—British Thomson-Houston Co., Ltd. May 13 1946. 631,006.

Drying phthalocyanine pigments.—General Aniline & Film Corporation. July 12 1946. 631,138.

Drying phthalocyanine pigments.—General Aniline & Film Corporation. July 12 1946. 631,139.

Production of monocyclic aromatic tricarbonimides and related compounds.—I.C.I., Ltd., J. Munro, and J. E. Gill. May 23 1947. 631,007.

Production of monocyclic aromatic triisocyanates.—I.C.I., Ltd., J. Munro, and J. E. Gill. May 23 1947. 631,025.

Recovery of polymeric materials.—Standard Oil Development Co. Aug. 23 1946. 631,272.

Chlorination of phthalic anhydride.—Niagara Alkali Co. Feb. 22 1944. 631,008.

Jets for the atomisation of fuel oils or the like.—B. H. Schieldrop. June 27 1947. 631,212.

Vat dyestuffs of the anthraquinone series.—I.C.I., Ltd., and A. Livingston. June 30 1947. 631,213.

Organo - dihalogenosiloxanes. — British Thomson-Houston Co., Ltd. Oct. 29 1942. 631,018.

Polyamides and processes for their production.—British Celanese, Ltd. Aug. 30 1946. 631,020.

Manufacture of dyestuffs of the xanthene series.—I.C.I., Ltd., and H France. July 16 1947. 631,040.

Manufacture of organo silicon-alcohols.—J. G. Fife. (Dow Corning Corporation). Aug. 26 1947. 631,049.

Manufacture of solutions of polyvinyl derivatives.—Soc. Rhodiaceta. Oct. 1 1946. 631,055.

Manufacture of thymoxyacetamidines.—Ciba, Ltd. Sept. 9 1946. 631,057.

Method and apparatus for fibreising molten material.—A. H. Stevens. (Johns-Manville Corporation). Sept. 23 1947. 631,061.

Manufacture of pyridyl-3-carbinol and process for obtaining same.—Roche Products, Ltd., and A. Cohen. Oct. 28 1947. 631,078.

Processes for the polymerisation of ethylenically unsaturated compounds.—E. I. Du Pont de Nemours & Co. Oct. 30 1946. 631,225.

Atomising nozzles.—Westinghouse Electric International Co. Nov. 15 1946. 631,082.

Means for freeing from dust and cleaning filtering or non-filtering walls or the like.—E. Damond. July 27 1937. 631,586.

Production of cyclohexane.—Anglo-Iranian Oil Co., Ltd., S. F. Birch, J. Habeshaw, and C. B. Collis. Oct. 19 1945. 631,309.

Apparatus for determining the Mach number in a stream of fluid.—Power Jets (Research and Development), Ltd., and R. P. Probert. March 19 1946. 631,453.

Nitric Oxide

The patent number of the specification under the name Wisconsin Alumni Research Foundation, referring to the production of nitric oxide, was incorrectly given last week. The number should read 630,715.

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SITUATIONS VACANT

None of the vacancies in these columns relates to a man between the ages of 18 and 50 inclusive, or a woman between the ages of 18 and 40 inclusive, unless he or she is exempted from the provisions of the Control of Engagement Order, or the vacancy is for employment exempted from the provisions of that order

THE CIVIL SERVICE COMMISSIONERS invite applications for appointments as **SENIOR SCIENTIFIC OFFICER** and **SCIENTIFIC OFFICER,** to be filled by competitive interview during 1950. Interviews will begin in January and will continue throughout the year, but a closing date for the receipt of applications earlier than December, 1950, may eventually be announced. Successful candidates may be appointed immediately. The posts are in various Government Departments and cover a wide range of Scientific research and development in most of the major fields of fundamental and applied science. Candidates must have obtained a University Degree in a Scientific subject (including Engineering) or in Mathematics with First- or Second-Class Honours, or an equivalent qualification, or possess high professional attainments. Candidates for Senior Scientific Officer posts must in addition have had at least three years' post-graduate or other approved experience. Candidates for Scientific Officer posts taking their degrees in 1950 may be admitted to compete before the result of their degree examination is known.

Age Limits.—For Senior Scientific Officers, at least 26 and under 31 on 1st August, 1950; for Scientific Officers, at least 21 and under 28 (or under 31 for established Civil Servants of the Experimental Officer Class) on 1st August, 1950. Salary scales for men in London: Senior Scientific Officers, £700 × 25—£900; Scientific Officers, £400 × 25—£650. Rates for women are somewhat lower.

Further particulars from the Secretary, Civil Service Commission (Scientific Branch), 7th Floor, Trinidad House, Old Burlington Street, London, W.1, quoting No. 2887.
4993/200.

SITUATIONS VACANT

SENIOR WORKS EXECUTIVE required for large firm of organic chemical manufacturers to take complete charge of production. Applications are invited only from fully qualified and experienced men aged not less than 40 who have already been in charge of large-scale production and administration of over 2,000 persons. Post is permanent and pensionable and only men of first-class ability and experience will be considered. Please address applications to **BM/ULA London, W.C.1.**

WORKS ENGINEER required to take charge of Engineering and Maintenance Department of medium-sized **Tar Distillation and Chemical Works** in N.E. England. Only those with sound all-round practical training and experience in control of labour need apply. A.M.I.Mech.E. or equivalent an advantage. It would also be considered an advantage if the applicant has experience in operation and maintenance of modern steam-raising plant. Age not more than 40 years. Superannuation scheme. Write, giving full particulars of age, experience and salary required, to **Works Manager, Box No. 2869, The Chemical Age, 154, Fleet Street, London, E.C.4.**

FOR SALE

A quantity of **FRASER MONO-RADIAL PUMPS,** Type P25, 750 lb. per sq. in. with 3 h.p. Brook motors and starters. Low price accepted. Box No. 2882, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

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BROADBENT 48-in. SUSPENDED TYPE HYDRO EXTRACTOR, overdriven from 15 h.p. motor 400/3/50 supply, together with Pony motor for slow running.

BROADBENT 48-in. HYDRO EXTRACTOR; three-point suspension, galvanised basket and complete with 15 h.p. motor, starting equipment and reverse current braking switch suitable for 400/440 volt 3-phase 50-cycle supply.

18-in. diam. WILKINSON OINTMENT MILL, with marble refining discs and enamelled hopper and agitator, and complete with driving motor.

TUNGSTONE ACID PUMPS. A number available in Ebonite, Bronze and Tufnol.

SILICA COILS of 2½ in. bore, comprising 60 ft. formed into seven turns at 2 ft. 6 in. diam., complete with teak supporting framework. (Brand new.).

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2—5 ft. diam. by 8 ft. long, jacketed.
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6—3 ft. diam. by 7 ft., fitted coils.
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Fitted double doors.
Condition as new.
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CUBA STREET, MILLWALL, E.14.

FOR SALE

600

PROCESS PLANT

8-IN. ROTARY VACUUM PUMP by **GENERAL ENGINEERING CO.** of Ratcliffe. Size, AV.110G. Cap., 1,126 cu. ft. per min. at 23 in. vacuum. Machine No. 1357. Direct coupled by flexible coupling to a 45 b.h.p. motor by Laurence Scott, 400/3/50, 585 r.p.m., with A.E.C. starter and isolator, automatic control panel giving visual indication. Unit complete with Foxborough control valve, gauges and connecting piping.

COMPLETE DISTILLED WATER PLANT, comprising six steam-heated Manesty stills, type No. 4, cap. 50 gal. per hr. each; one automatic loading tank; two direct motor-driven rotary pumps; vertical pressure storage tank of welded construction, suitable lagged, approx. 11 ft. deep by 5 ft. 6 in. diam., with raised manhole 2 ft. diam., with eighteen 1 in. diam. swing bolts for securing. Unit complete with all connecting piping, valves, etc.

M.S. ROTARY DRIER, drum 25ft. × 5 ft. I.D., with short screen at discharge end, fitted internally M.S. channel flights and two roller paths running in tandem rollers. Drive through girth wheel and pinion with countershaft and fast and loose pulleys. Heating by multi-bank gilled tubes.

TWO **100-BARREL CAP. M.S. GLASS-LINED TANKS,** each 9 ft. diam. by 10 ft. high by $\frac{3}{8}$ in. plate, in four flanged bolted sections with dished bottom and domed top. Large manhole in bottom side, bottom centre outlet.

Twelve **80-BARREL CAP. M.S. GLASS-LINED TANKS,** 7 ft. 6 in. diam. by 10 ft. high by $\frac{3}{8}$ in. plate, bolted sections with dished bottom and domed top. Large manhole in bottom side, bottom centre outlet.

HORIZONTAL MIXER by **KRUPP,** 5 ft. by 5 ft. diam. by 5 ft. deep, fitted double "Z" mixing arms and having pump discharge, motorised 400/3/50.

VERTICAL MIXER by **BRIERLEY, COLLIER AND HARTLEY,** fitted stainless steel steam-jacketed pan 18 in. diam. by 10 in. deep, steam W.P., 15 lb. per sq. in., arranged with stainless steel spiral agitators, belt drive.

12 **TROUGH MIXERS,** by **HOISTING APPLIANCES,** with M.S. trough 14 in. diam. by 14 in. by 18 in. deep, fitted gate-type agitators, motorised 400/3/50, and fitted hand-tilting hinged cover.

GEORGE COHEN SONS & CO. LTD.,
SUNBEAM ROAD, LONDON, N.W.10,
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FOR SALE

VARIOUS MIXERS FOR SALE

No. 200 ONE nearly new **WERNER PFLEIDERER JACKETED MIXER OR INCORPORATOR.** Low type, with C.I. built mixing chamber, 28 in. by 29 in. by 27 in. deep, with double "U"-shaped bottom which is jacketed, and double fish-tail or fin-type agitators geared together at one side, with belt-driven friction pulleys, 34 in. diam. by 5 in. face, with hand-wheel operation and hand-operated screw tilting gear. Machine fitted with machine-cut gears, covers, gear guard, cast-iron baseplate, and measuring overall approximately 7 ft. by 6 ft. by 4 ft. high to the top of the tipping screw.

No. 201 One **DITTO.**

No. 202 One **DITTO.**

No. 203 One **DITTO.**

No. 204 One **WERNER PFLEIDERER MIXER OR INCORPORATOR,** similar to the above, with a C.I. built pan 25 in. by 25 in. by 19 in. deep, belt pulleys 26 in. diam. by 5 in. face, double fin-type agitators, and mounted on C.I. legs.

No. 205 One larger **WERNER-TYPE MIXER OR INCORPORATOR,** by Dobson & Barlow, with C.I. built pan or mixing chamber, of the double "U" type, 4 ft. 6 in. by 3 ft. 7 in. by 3 ft. 10 in. deep, with a jacketed bottom and sides to within about 12 in. of top, and fitted with double "Z" type agitators, counterbalanced cover, machine-cut gears at each side, steel back-frame with counterbalancing weights and self-contained belt-driven tipping gear and main triple fast and loose belt pulleys 30 in. diam. by $6\frac{1}{2}$ in. face, with belt fork. Approximate overall sizes, 12 ft. long by 8 ft. wide by 10 ft. high.

No. 206 One **DITTO** of the same pattern, by **DOBSON & BARLOW.**

No. 207 One **DITTO** of the same pattern, by **DOBSON & BARLOW.**

No. 208 One **DITTO** by **WERNER PFLEIDERER,** with a C.I. built pan or mixing chamber, of the double "U" type, 4 ft. 5 in. long by 3 ft. 8 in. by 33 in. deep, with double "Z" mixing arms, gears at each end, hand-operated tilting gear, with steel backframe, counterbalancing weights and chains, and fast and loose pulleys 3 ft. diam. by 6 in. face.

No. 209 One **HORIZONTAL "U"-SHAPED MIXER,** steel built, riveted, measuring about 8 ft. 3 in. long by 3 ft. wide by 3ft. 3 in. deep, with horizontal shaft, fitted with bolted-on mixing arms about 18 in. long by 4 in. wide, with intermediate breakers, and driven at one end by a pair of spur gears, with countershaft, fast and loose belt pulleys, outer bearing and plug cock type outlet at the opposite end, mounted on two cradles fitted to two R.S.J. running from end to end.

No. 210 One **HORIZONTAL MIXER** as above.

No. 211 One **HORIZONTAL MIXER** as above.

No. 212 One **HORIZONTAL MIXER** as above.

No. 213 One **HORIZONTAL MIXER** as above.

No. 214 One **HORIZONTAL MIXER** as above.

These six "U"-shaped mixers are in some cases fitted with steel plate covers and a steam jacket round the bottom and extending to within about 18 in. of the top with plain end plates.

Further details and prices upon application.

Write RICHARD SIZER LIMITED, ENGINEERS, CUBER WORKS, HULL.

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ONE ROTARY AIR COMPRESSOR by Hick Hargreaves, 546 cu. ft./min. at 10 lb. p.s.i. 960 r.p.m.
NINE—Andco 6 in. **WORM OPERATED PLUG COCKS.**
ONE—Andco 1½ in. **WORM OPERATED PLUG COCK.**
FOURTEEN—¾ in. **WORM OPERATED PLUG COCKS.**
ONE—Steel cased **WORM CONVEYOR** 8 ft. long.
ONE—Sectional pressed **STEEL STORAGE TANK,** 12 ft. by 12 ft. by 8 ft.
ONE—Insulated **MILD STEEL COLUMN,** dish ends, 3 ft. 11 in. diam., by 11 ft. 3 in. high.
SIX—Enclosed **CAST IRON RECEIVERS,** 3 ft. diam. by 3 ft. 6 in. deep, fitted with brass basket coil and sight glasses.
ONE—All brass **PRODUCT RECEIVER,** 2 ft. 11 in. diam., by 3 ft. 10 in. deep.
TWO—All brass **PRODUCT RECEIVER,** 2 ft. 11 in. diam., by 4 ft. 9 in. deep.
ONE—Lead lined welded **M.S. ETHYLENE COOLER,** 3 ft. diam., by 3 ft. 6 in. deep.
ONE—All brass product **HEAD TANK,** 3 ft. 11 in. diam., by 4 ft. 9 in. deep.
FOUR—C.I. **CONDENSER SHELLS,** 2 ft. 9 in. diam., by 9 ft. long.
TWO—**C.I. BLENDING VESSELS,** 2 ft. 6 in. diam. by 4 ft. long.
SIX—**C.I. CATCHPOTS,** 1 ft. 6 in. diam., by 1 ft. 9 in. deep.
EIGHT—**C.I. MIXING VESSELS,** 2 ft. 6 in. diam., by 2 ft. 3 in. deep.
EIGHT—**Enclosed C.I. Ethylene Receivers,** 3 ft. diam. by 3 ft. 6 in. deep.

ABELSON & CO. (ENGINEERS) LTD.
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TWO—**ENAMELLED VESSELS,** 150 litre capacity, mounted in mild steel baths, fitted with cooling coil and provision for electric heater; bolted-on dished covers fitted sight and light glasses, 3 by 2 in. branches, 1 by 3 in. branch, charge-hole and 6 in. bore distillation hand.
Two—**ENAMELLED VESSELS,** 75 litre working capacity, one mounted on water bath with cooling coil and provision for electric heater; bolted-on dished covers, glanded anchor stirrers, various branch, charge-hole, etc.
One—**STEAM-JACKETED TOTALLY ENCLOSED ENAMELLED VESSEL,** 70 litre capacity, bolted dished cover, anchor type glanded stirrer, branches, charge-hole, etc., suitable 50 lb. jacket pressure.
One—Size 20 **"GERYK" VACUUM PUMP** by the Pulsometer Engineering Co.
One—**LABORATORY PORCELAIN EDGE RUNNER MILL,** about 15 in. diameter.

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PHONE 98 STAINES

JACKETED "Z" BLADE VACUUM MIXER, 28 in. by 26 in. by 20 in.
"BROADBENT" THREE-POINT SUSPENSION 48-in. HYDRO, 400/3/50.
"WEIR" and "SERCK" CONDENSERS, 350, 160 and 120 sq. ft.
JACKETED CYLINDRICAL MIXERS, 6 ft. by 3 ft. deep, 3 ft. 6 in. by 4 ft. deep and 25 in. by 25 in. deep.
HORIZONTAL AND VERTICAL AUTOCLAVES, 6 ft. by 3 ft. diam., 3 ft. by 2 ft. diam. and 18 ft. and 15 ft. by 2 ft. diam.

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FOR SALE

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TWIN-CYLINDER **HASLAM COMPRESSOR,** direct coupled to 10 h.p. 400 volt. 3-phase 50 cycle motor, having a capacity of 6 tons refrigeration.
STERNE REFRIGERATION PLANT, comprising twin-cylinder Ammonia Compressor, 3 in. bore by 4 in. stroke, flywheel and pulley drive, with brine tank 6 ft. 6 in. long by 18 in. wide by 4 ft. 6 in. deep, complete with evaporator coil 1¼ in. bore, 26 pipes high, 5 ft. 6 in. long, approximately 312 ft.
One—Shell and Tube **AMMONIA CONDENSER,** 9 ft. long by 10 in. diam.
One—Shell and Tube **AMMONIA CONDENSER,** 6 ft. long by 18 in. diam. Complete with oil separator.
Two—**BRINE TANKS AND COILS,** 6 ft. by 4 ft. by 12 in. wide, complete with 1¼ in. bore ammonia coil, double wound 5 ft. long, 12 pipes high, 120 ft. total length.
A. G. ENOCK 6 in. by 6 in. **TWIN-CYLINDER VERTICAL SINGLE-ACTING AMMONIA COMPRESSOR,** having nominal evaporator of about 27 tons refrigeration and 10-11 tons ice making; suitable for 30 h.p.

REED BROTHERS (ENGINEERING) LIMITED,
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NEW unused **BEKEN VACUUM DUPLEX MIXER,** complete with bedplate, reduction gear, less motor and starter. Type **ST.** 56 gallon cap.
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ONE 100 KVA 400/3/50 Browett Lindley/Westinghouse **STEAM GENERATING SET,** 120 lb. p.s.i. working pressure.
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ONE PELLETING MACHINE, Thompson & Capper, 1½ in. pellet, fast and loose pulley drive. Good condition. £100.

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REQUIRED, **ROTARY CALCINING FURNACE,** approximate dimensions, 30 ft. long by 4 ft. diameter, preferably oil fired. Full particulars to Box No. 2880, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

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